Research on the Development Trend and Risk of Digital Currency——Based on the GSADF

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Abstract: In this paper, the comprehensive comparison of digital currency worldwide is shown and development present situation and the risk for the challenge uses GSADF method to examine digital currency bubbles, and describes the price trends and price series of Bitcoin, Litecoin and Ripple from 2016 to 2021, measuring the characteristics of digital currency price fluctuations. Through the comparative analysis of the data series, the existence of bubbles and the causes of bubbles are studied, and the reasons for the bubble of digital currency price fluctuations are comprehensively analyzed. This paper concludes that investor speculation, government supervision and the international macroeconomic situation will affect the price fluctuation of digital currency, and gives methods and policy suggestions to deal with risks.

1. Introduction

With the deepening of global economic integration, virtual digital currencies such as bitcoin have developed rapidly in a decentralized environment. However, due to the decentralized nature of digital currencies and the lack of supervision, the price of digital currencies has often been in a state of violent fluctuations in recent years. For users of digital currency, sharp currency fluctuations undoubtedly bring great risks in the use of digital currency. Compared with the dollar or gold, encrypted digital currency is more like a risk asset, its risk is much greater than stocks, futures, its speculative properties are huge, and some digital currencies even fluctuate sharply according to the issuance of currency [1]. Similarly, in the context of such accelerated globalization and the increase in digital currency mining, the consolidation of the status of their own currencies has gradually become an urgent problem to be solved. This paper comprehensively compares the development status and risks and challenges of digital currencies, and examines the digital currency bubbles of Bitcoin, Litecoin, and Ripple from 2016 to 2021 using the GSADF method proposed by Phillips et al. (2015a) to examine whether there is a bubble. Through the risks of digital currency and the occurrence and bursting of bubbles, we will study the risks and challenges that may be faced and put forward corresponding policy recommendations.

2. Literature review

In the context of the accelerated evolution of global economic integration, virtual digital currencies such as bitcoin have developed rapidly in a decentralized environment, and the value of digital currencies is often affected by economic policies such as currency issuance and the implementation of regulatory measures in various countries [2]. Luo Liangwen (2018) pointed out that the use of digital currencies is risky and often extremely risky, which will often directly harm the interests of investors and may even affect the stability of the monetary policy issued by the state. Asset price bubble refers to the abnormal rise in asset prices and the gradual deviation from the price determined by the real economy such as products and labor and determined by its intrinsic value [3]. The test analysis methods of rational foam are divided into: unit root-cointegration test (Diba & Grossman, 1988), which tests whether there is a unit root of a stationary sequence in the sequence, but it is not suitable for complex linear evolution processes; The variance bounds test (Shiller, 1980), which is used for the significance test of the mean difference between two or more samples, calculates the value variance size by comparison. In contrast, the generalized unit root test (Phillips et al., 2011; 2015a) is based on the idea of forward recursive regression[4]. Under the framework of ADF model, the Dickey-Fuller right-hand unit root test method was used to test foam. Subsequently, Phillips et al (. 2015a) proposed a more widely used test method GSADF test based on the SADF test method[5].

Based on the above research analysis, it is found that the use of GSADF test method to test the price bubble interval of digital currency can reduce the error that cannot judge the complex linear evolution when the unit root-cointegration test is used in existing studies, and can solve the problem that the connection bubble interval, start and end point class cannot be calculated. Compared with the two-step test, the GSADF test can be used to improve the deviation of the results in small samples.

3. Modeling specification and variable selection

3.1 Augmented Dickey-Fuller test (ADF TEST) on the right

The original bubble analysis method was based on asset pricing equations.

$$P_t = \sum_{i=0}^{\infty} \left(\frac{1}{1+r_f} \right)^i E_t(D_{t+i} + U_{t+i}) + B_t \tag{1}$$

Among them, P_t represents the price of the asset at moment t, D_t represents the return obtained from the asset, r_r represents the risk-free interest rate, U_t represents unobservable fundamental factors, B_t as a bubble component. In general, we use the equation $P_t^J = P_t - B_t$ as a method for calculating market fundamentals[6]. Because B_t is explosive, in the absence of a bubble, i.e. $B_t = 0$, the degree of non-stationarity in asset prices is controlled by asset returns and unobservable fundamental factors.

$$E_t(B_{t+1}) = \left(1 + r_f\right) B_t \tag{2}$$

When the price bubble of the asset explodes P_t at moment t, it proves that the bubble component at moment t B_t exists.

3.2 Generalized Supremum ADF test

Because the ADF foam test method on the right is not obvious in the continuous foam interval, the error is large. Peter C. B. Phillips proposed the SADF foam test method and the GSADF foam test method in 2015 based on the right-hand ADF test.

$$GSADF(r_0) = \quad r_2 \in [r_0, 1] \quad \{ADF_{r_*}^{r_2}\} \tag{3}$$

Peter C. B. Phillips obtained the GSADF test method by improving the recursive use of sample sub data on the basis of the SADF foam test, and from (4) it can be seen that the GSADF test method is different from the SADF foam test, in addition to changing the minimum window width of the r_2 from r_0 to 1, the GSADF test method also allows the starting point r_1 to no longer be fixed at 0, but to move within the feasible range of r_0 to r_2. In general, the GSADF statistic is defined as the maximum ADF statistic that is recursive within a feasible range of r_1 to r_2 and expressed in terms of GSADF(r_0).

3.3 Empirical analysis of digital currency price bubble based on GSADF

This paper selects the daily data of Bitcoin from July 2016 to April 2021, Litecoin from August 2016 to April 2021, and Ripple from January 2017 to April 2021 as the price indicators to measure the price of the three digital currencies.
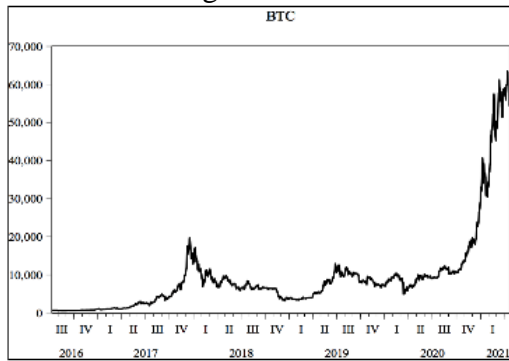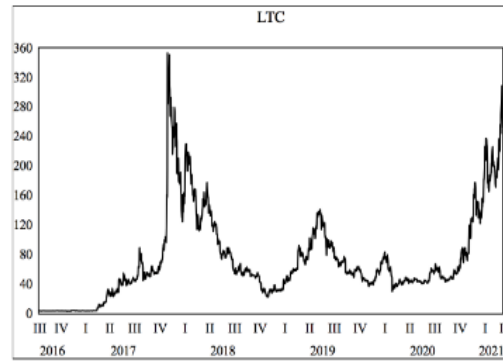

Figure 1: BIT price action
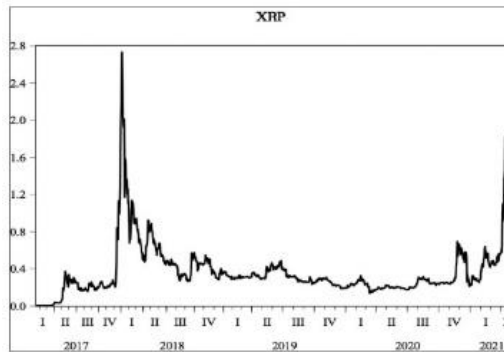

Figure 2: LTC price action

Figure 3: XRP price action

It can be seen from Figure 1 to Figure 3 that between the fourth quarter of 2017 and the second quarter of 2018, the price of bitcoin has experienced a relatively large fluctuation, which is reflected in the continuous rise of bitcoin price in the fourth quarter of 2017, which shows that the price of bitcoin fluctuates and fluctuates sharply overall. From the second quarter of 2020 to the end of the first quarter of 2021, it can be seen that the overall price of Bitcoin is in a state of continuous and significant growth. Figure 2 depicts the price trend of Litecoin from the third quarter of 2016 to the second quarter of 2021, first of all, it can be seen that the price of Litecoin has continued to rise from the first quarter of 2017, and the price of Litecoin has increased significantly and sharply from the fourth quarter of 2017 to the first quarter of 2018, from $47.64/LTC on September 24, 2017 to $350.66/LTC on December 19, 2017. Overall, the price of Litecoin has changed tremendously. Figure 3 shows that the price of Ripple was stable throughout 2017, but from the end of 2017 to the

beginning of the first quarter of 2018, the overall price of Ripple continued to rise sharply and sharply, and then in the second quarter of 2018, the overall decline in fluctuations continued in the third quarter, and there was a brief small increase in the fourth quarter of the same year. Overall, the price movement of Ripple also fluctuates greatly.

4. Results and discussion

This paper determines the beginning and bursting nodes and survival cycles of digital currency price bubbles by comparing the GSADF statistical value series with the 95% threshold value series. At the same time, this paper selects the GSADF statistical value series as a bubble series to measure the degree of digital currency price bubble. In this paper, the maximum statistical value in the GSADF statistical value series within the range of price bubble phenomenon is selected as the bubble peak, and this is used as a parameter to measure the degree of price bubble. The red line in the figure below represents the critical value, the black line represents the BSADF value, and the part of the black line above the red line represents the presence of a price bubble.
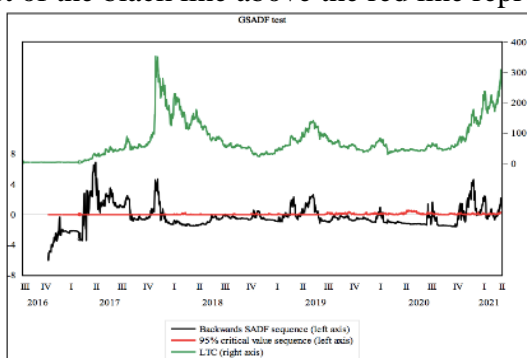

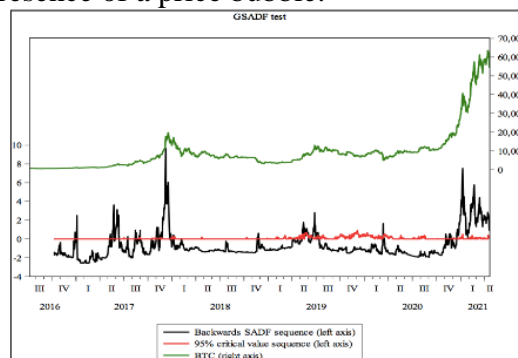Figure 4: GSADF test result of the BIT
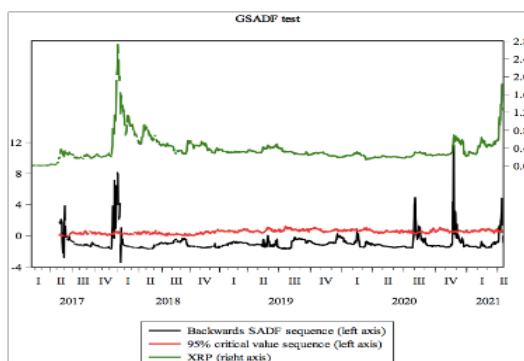
Figure 5: GSADF test result of the LTC

Figure 6: GSADF test result of the XRP

According to figure 4 to figure 6, it can be found that the Bitcoin bubble was concentrated from early May 2017 to early 2018 and early May 2019 to early 2020, and from the end of 2020 to the end of the first quarter of 2021. In 2017, the rapid and unusually hot development of ICO projects drove a large number of investment demand. This has caused a sharp increase in the demand for bitcoin, and also caused the price of bitcoin to continue to soar. At the beginning of 2015, global trade financing was $14 million, and by 2017, ICO funding had increased sixfold from 2016, bringing together more than $1.2 billion. In China, as of the end of 2017, the cumulative number of domestic ICO participants was as high as 105,000, and the financing scale reached 2.6 billion yuan. However, as a large number of digital currencies were sold off for the purpose of obtaining funds, People's Bank of China timely issued the "Announcement on Preventing the Financing Risk of

Token Issuance", which will carry out a comprehensive liquidation and withdrawal of virtual currencies and financing tokens in China. At the same time, capitalist countries led by the United States have also strengthened the regulation of digital currencies such as bitcoin, which has led to "de-bubble" on a global scale. The price of Bitcoin began to drop significantly, and the Bitcoin bubble finally burst in early 2018. In mid-2019, due to the intensification of the Sino-US trade war, bitcoin as an investment tool that can be used to diversify risks, buying bitcoin has become a way for people to cope with the depreciation of the yuan and at the same time preserve and appreciate the value of assets. However, the Sino-US trade war has entered a fever pitch and led to a certain degree of recession in the market economy, so investors generally have pessimistic expectations, which directly led to investors being more inclined to increase investment in value-preserving assets such as gold, so the price bubble of bitcoin burst again in early 2020. At the end of 2020, the price of bitcoin began the longest lasting price bubble range, due to the prolonged epidemic led to the global economic malaise, at the end of 2020, the United States launched an economic stimulus package, due to the Federal Reserve increased the issuance of banknotes, resulting in a surge in the price of U.S. stocks and U.S. bonds, stimulating investors to start buying a large number of digital currencies such as bitcoin. Similarly, the central bank has also begun the pilot of digital currency DCEP, which undoubtedly increases investors' propensity to buy digital currency.

5. Conclusion and policy recommendation

5.1 Conclusion

This paper is based on the value of the Japanese yen of the world's three major digital currencies: Bitcoin, Litecoin and Ripple, from 2016 to 2021. Analysis of price trends reveals price bubbles in Bitcoin, Litecoin, and Ripple. After horizontal comparison, it is found that the price bubble of three digital currencies such as bitcoin lasts the longest from mid-2017 to early 2018 and from the end of 2020 to early 2021, and the GSADF test fully shows the price bubble of the three digital currencies and the volatility and instability of the currency value. Combined with the empirical and practical explanations of the reasons for the fluctuation of digital currency value and price bubble, this paper concludes that the price fluctuation of digital currency is affected by investor speculation, government supervision and the international macroeconomic situation.

5.2 Policy recommendation

On one hand, investors should remain rational and soberly realize that digital currencies are highly volatile, high-risk and complex due to decentralization and lack of regulation, and should not blindly follow the trend of investment. Secondly, regulators can stabilize the price fluctuations of digital currency by strengthening the supervision of digital currency. Similarly, it is also necessary to strengthen the improvement of the market supervision system and formulate clear regulatory measures, strengthen the monitoring of the trading platform, and actively guide the healthy and sustainable development of the digital currency market. On the other hand, central banks should also accelerate the issuance and pilot of their own legal digital currency, so that digital currency can be issued and used under national supervision, which can reduce blind speculation and lack of government supervision to a certain extent. Finally, when investing in digital currency, it is also necessary to reasonably consider the international macroeconomic situation, recognize the horizontal connection between digital currency and the connection between digital currency and the international macroeconomic situation, and fully grasp the information of digital currency price range before making investment decisions to reduce investment risks.

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