Study on the Price Bubble of XRP

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Abstract: *Since the cryptocurrencies based on blockchain technology have been published on the market, their prices have risen explosively and dropped precipitously. The issue of price bubbles, which is dominated by bitcoin and ETH, has attracted widespread attention from many scholars. However, there is no research on whether there is a price bubble in XRP, which already has cross-border payment applications. For this reason, this article has carried on the correlation research to the XRP's price bubble question. Firstly, the article defines the asset price bubble accurately. Next, it analyzes the volatility of the price of XRP. In addition, it establishes the pricing model of XRP from the perspective of use value, and estimates its intrinsic value. Finally, according to the market price and intrinsic value of XRP, it measures the bubble level of the XRP, and concludes that there is a big price bubble in the XRP. Combined with the inspection and measurement of the price bubble of XRP, we put forward some investment suggestions to the relevant investors.*

Keywords: block chain, encrypted currency, XRP, price bubble

1. Introduction

Due to the continuous development of Internet technology, a large number of innovations based on this technology continue to appear. The emergence of blockchain technology has aroused widespread concern of the whole society, which is committed to the realization of decentralized payment. At the same time, cryptocurrencies based on blockchain technology, such as bitcoin and ETH, are also born [1]. This kind of cryptocurrency is wildly sought after by global investors, which leads to sharp fluctuations in the price of this kind of cryptocurrency in a short period of time. The sharp fluctuation of price makes investors have to consider whether there is price bubble in this kind of virtual currency.

Ripple is a blockchain company with commercial products, which is committed to using blockchain technology to provide customers with cross-border payment solutions. Ripple's global payment network includes more than 300 customers in more than 40 countries on six continents. In 2013, Ripple issued XRP, a relatively centralized cryptocurrency that can be paid globally. The introduction of this cryptocurrency increases the liquidity of Ripple's global payment network, improves the speed of cross-border payment, and greatly reduces transaction costs.

The reason why this paper chooses XRP money as the research object is mainly because the virtual currency such as bitcoin and ETH square has not been applied in real life, so this kind of encryption currency does not reflect the practical application value. As a pure investment tool, the price fluctuation itself shows a price bubble. As the basic currency of Ripple network, the XRP has been used in cross-border payment, which shows that the XRP is a kind of cryptocurrency with practical application value. If we can measure the intrinsic value of XRP through a certain technical means, we can find out whether there is a price bubble in XRP through the study of its market price. Then the conclusion of this paper can provide the theoretical basis for the investors of the XRP.

2. Literature Survey

Economists' definitions of bubbles can be roughly classified into two categories.

One is the definition of bubble formation and rupture. For example, economist Kindleberger (1978) defines bubbles as a process of skyrocketing asset prices to plunge. Kindleberger believes that rising prices will lead people to expect prices to continue to rise, thereby attracting new investors. These new buyers are not concerned about the value of assets and the ability to create profits. Their aim is the spread of asset transactions, and when prices are expected to reverse, prices will collapse and the bubble will burst. Galbraith (1994) pointed out that asset prices surged due to excessive speculation in the economy, which led to price collapse, market confusion and economic depression. Such definitions emphasize the form and process of bubbles.

The second category is defined by the deviation between price and value. For example, Peter Garber (2003) defines bubbles as part of asset price fluctuations that cannot be explained by fundamentals, that is, the deviation from asset values when asset prices fluctuate. Japanese economist Lin (1995) believes that the bubble is the continuous rapid expansion of assets such as land and stock, leading to an increase in asset value far beyond the growth of fixed assets such as machinery and buildings. Noguchi Yukio (2005) defined the bubble as the difference between the real asset price and the underlying asset value. This kind of definition compares the price with the basic value of the asset, and emphasizes the deviation degree of the price [2].

In fact, the above two definitions can be regarded as the definition of the bubble process (skyrocketing to collapse) and the bubble component (price and value deviation). The foam process is a dynamic description of the process of change. The foam component is a part of the deviation from price in the price [3]. It is a static concept. But in fact, these two definitions only interpret the price bubbles from different angles, and the sharp rise and fall of prices will naturally lead to obvious price deviations. At the same time, when the price

deviates greatly, the price tends to return to the value, so the price will change dramatically and fall back. Therefore, the study of asset price bubbles should start from two aspects: the dynamic bubble process and the static bubble component.

In this paper, economists Kindleberger and Noguchi Yukio combined the analysis of bubbles, and defined the asset price bubble as the difference between the real asset price and the underlying asset value, and accompanied by the skyrocketing and plunging asset prices.

Many scholars have also put forward various methods for the study of asset price bubbles. Some scholars try to test the price bubble of digital currency bitcoin by GSADF. Malhotra & Maloo (2014) selected the bitcoin price data from September 2011 to February 2014 for the unit root structure breakpoint test and SADF test, and found that the breakpoint of bitcoin price structure occurred after the closure of the Silk Road website, and there were 3 price bubbles in the sample period. In view of which method is more suitable for studying the price bubble of virtual currency, scholars from different countries have given their respective views. The sup ADF method proposed by Phillips et al. is based on asset price time series sample data, combines the forward recursive regression idea and the right unit root method to test the existence and duration of bubbles. Homm & Breitung (2012) proves that SADF test method has a higher advantage than other foam detection methods through simulation Monte Carlo. Because there is no need to directly estimate its intrinsic value, the above methods have obvious advantages and applicability in the detection of digital money bubbles. However, these methods all study the price bubbles from the perspective of asset price fluctuation, but few studies on the components of bubbles. Therefore, this paper tries to calculate its intrinsic value from the perspective of the value of XRP, and then calculates the bubble level of the XRP by comparing the market price and the intrinsic value of the XRP.

3. Measurement of price bubbles in XRP

3.1 Descriptive statistical analysis of the market price of XRP

First of all, this paper studies the price bubble of XRP from the dynamic bubble process, and preliminarily determines whether there is bubble in XRP. From August 7, 2014 to August 8, 2019, the paper selects the closing price of the daily XRP, a total of 1828 price data. This paper uses SPSS data analysis software to draw the line chart of daily closing price in time order. As shown in figure (1).
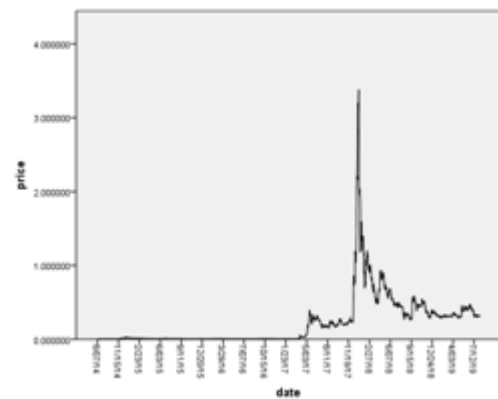

Figure 1: Line Chart of daily closing price of XRP

The following information can be obtained from the market price trend chart of the XRP: before March 2017, the price of the XRP remained stable at a low level, and there was little significant price fluctuation. After March 2017, the price of the XRP began to fluctuate significantly. The market price of RBC peaked on January 7, 2018. The market price of each RBC was $3.38, and its market value exceeded $13 billion, surpassing ETH as the second largest cryptocurrency after bitcoin. On December 7, 2017, the price of the XRP was only $0.22 per coin, which rose to $3.38 per coin in just one month, with a single month price increase of 14346%. However, the price rise of the XRP didn't last for a long time. On February 7, 2017, the price of the RMB dropped rapidly to US $0.72 each, and the price of the single month dropped 78.7%. In just two months, the price of the Swiss currency rose and fell sharply. This phenomenon is very similar to the physical expansion and rupture of bubbles.

Using SPSS data analysis software to carry out descriptive statistical analysis on the daily closing price of XRP, you can get the following two tables:

Summary Statistics

Table 1

	N	Minimum value	maximum value	mean value
Closing price	1828	.004090	3.380000	.21905335
Valid n	1828			

Table 2

	skewness		kurtosis	
	Statistic	Standard error	Statistic	Standard error
Closing price	3.559	.057	20.068	.114
Valid n				

It can be seen from table (2) that the skewness coefficient of daily closing price XRP is 3.559, and the image is on the right. And the kurtosis coefficient is as high as 20.086, so the market price distribution of the XRP is more steep than the normal distribution, and it can be concluded that the XRP has a large price fluctuation. This is consistent with the information reflected in the daily closing price chart of the XRP.

From the perspective of yield, we analyze the problem of XRP's price bubble. The daily rate of return of the XRP is

calculated by the formula: rate of return = (closing price - opening price) / opening price. By processing the daily closing price data, we can get the daily yield data. Use SPSS data analysis software to draw a line chart of daily yield in chronological order, as shown in figure (2).
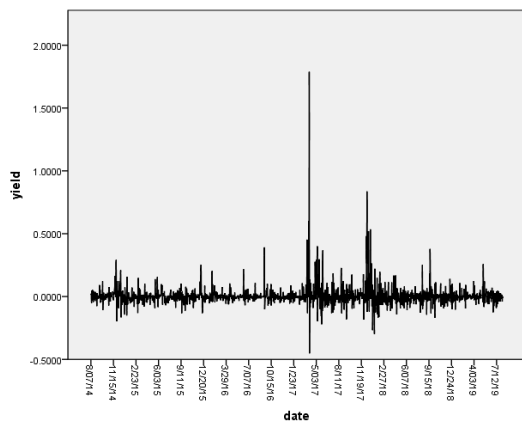

Figure 2: Daily Yield line chart of XRP

It can be observed from the trend chart of the market yield of XRP: most of the daily yield of XRP is in the range of -25% ~ 25%, and there are some days when the yield exceeds 25%, and there has been an extreme phenomenon that the yield exceeds 50%. On April 2, 2017, the single day yield of the XRP rose by 178.8%, with 83.6% and 60.1% huge increases, 96 times more than 10%. On April 3, 2017, the one-day yield of the Swiss currency dropped by - 45.2%, and it dropped by more than 46 times more than -10%. Using SPSS data analysis software to carry out descriptive statistical analysis on the daily rate of return of XRP, you can get the following two tables:

Table 3

Summary statistics				
	N	Minimum value	maximum value	mean value
Rate of return	1828	-.4523	1.7878	.004734
Valid n	1828			

Table 4

	skewness		kurtosis	
	Statistic	Standard error	Statistic	Standard error
Rate of return	8.099	.057	153.978	.114
Valid n				

It can be seen from table (4) that the skewness coefficient of the daily yield of the XRP is 8.099, and its yield image is on the right. And the kurtosis coefficient is as high as 153.978, so the distribution of the return rate is steeper than that of the normal distribution, and it can be concluded that the price of the Swiss currency fluctuates greatly. This is consistent with the information reflected in the daily yield line chart of the XRP.

From the perspective of price volatility, we analyze the problem of XRP's price bubble. The formula of daily price volatility is: price volatility = (maximum price per day - minimum price per day) / minimum price per day. Through the processing of the daily market price data, we can get the daily price volatility data. Use SPSS data analysis software to draw a line chart of daily price volatility in chronological order, as shown in figure (3).
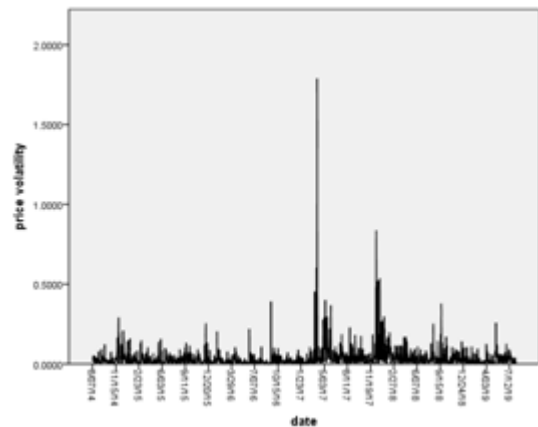

Figure 3: Daily Price volatility line chart

It is calculated that the average daily price volatility of the XRP is 6.9% from August 7, 2014 to August 8, 2019. From March 17, 2017, when XRP became the mainstream cryptocurrency, to August 8, 2019, the average daily price volatility of XRP was 10.06%. The maximum price fluctuation period observed directly from the image is from December 7, 2017 to February 7, 2018, during which the average daily price fluctuation rate of XRP is 25.5%.

Using SPSS data analysis software to carry out descriptive statistical analysis on the daily price volatility of XRP, the following two tables can be found:

Table 5

Summary statistics				
	N	Minimum value	maximum value	mean value
Volatility	1828	.0000	2.2928	.069264
Valid n	1828			

Table 6

	skewness		kurtosis	
	Statistic	Standard error	Statistic	Standard error
Volatility	8.186	.057	122.932	.114
Valid n				

It can be seen from table (6) that the XRP skewness coefficient of the daily price volatility of the XRP is 8.186, and its image is on the right. And the kurtosis coefficient is as high as 122.932, so the distribution of price volatility is steeper than that of normal distribution, so it can be concluded that the price volatility of XRP is relatively large. This is consistent with the information reflected in the daily price volatility line chart of the XRP.

To sum up, the market price of the XRP presents a sharp fluctuation phenomenon. Soaring asset prices and slump are important manifestations of asset bubbles. Therefore, according to the dynamic bubble process in the concept of asset price bubble, there may be asset price bubbles in XRP.

In addition to analyzing the price bubbles of XRP money from the perspective of dynamic bubble process, the article also needs to further study the price bubble of XRP money from the perspective of static bubbles. It provides sufficient theoretical basis for judging the existence of price bubbles in XRP.

3.2 Calculation of the intrinsic value of the XRP

The pricing of cryptocurrency is always a research difficulty, which is determined by the special nature of cryptocurrency. Some researchers believe that cryptocurrencies such as bitcoin and ETH are of no value because they are not used in real life except as a speculative product. Some researchers also think that bitcoin and other cryptocurrencies are valuable, and use the cost method to compare the value of bitcoin.

As a kind of cryptocurrency, the particularity of the XRP is that it has been applied to the field of cross-border payment. As the circulating currency in Ripple network, XRP can complete the transmission of cross-border payment within 3-5 seconds, and only needs to pay a very low transaction cost. Due to the fact that the real application scenario has been realized, the price of the XRP can be set from the perspective of use value in the process of research.

First of all, according to the relevant properties of the XRP, the pricing model of the XRP is established. The value of each XRP is equal to the ratio of the total value of the XRP to the total number of the XRP. The total value of the XRP is equal to its use value, which is mainly reflected in its role in cross-border payment. Therefore, the total value of XRP directly depends on its participation in the field of cross-border payment. The market share of cross-border payment business can be used as a quantitative indicator to measure the total value of XRP. The market share of cross-border payment business conducted with XRP is directly related to the business and amount of payment processing. From this, we can establish the pricing model of XRP.

Hypothesis 1: All the XRP participating in cross-border payment are always involved in cross-border payment (making full use of time and space for each XRP to fully reflect its value).

Assumption 2: All the XRP issued by Ripple company can only be used as circulating currency and safe currency in Ripple network (open market transaction is not allowed).

$$v = m/f ①$$

In formula ①, v is the intrinsic value of XRP; m is the average transaction amount of each cross-border payment in which XRP participates; f is the average amount of XRP used in each cross-border payment in which XRP participates.

$$m = M/N ②$$

In formula ②, M is the total amount of transactions processed for cross-border payment with XRP each year; n is the total number of cross-border payment transactions with XRP each year.

$$f = c/n ③$$

In formula ③, c is the number of XRP participating in cross-border payment per second under full utilization; n is the number of transactions involving XRP per second.

$$n = N/T ④$$

In formula ④, T is the total number of seconds in a year.

$$c = C/t ⑤$$

In formula ⑤, C is the number of XRP that can participate in cross-border payment transactions; t is the processing time of a single transaction through XRP, which is 3-5 seconds, taking the expected value for the processing time of a single transaction. If the processing time of a single transaction through XRP is 4 seconds, then t = 4.

$$C = A - N*K - 20*Y ⑥$$

In formula ⑥, A is the supply quantity of XRP; N is the total number of cross-border payment transactions that XRP participates in every year. K is a constant, with a value of 1 / 10000, which means: a million of XRP will be consumed for each transaction completed. Y is the number of users in the Ripple payment system. 20's means is that in order to ensure the security of accounts in the ripple network, each account needs to hold 20 XRP cannot be circulated.

After sorting out the above formula, the pricing model of XRP is as follows:

$$v = M*t/[T*(A-N*K-20Y)] ⑦$$

The coefficients of T, t, a and K in equation ⑦ are all constant, so the value of the coins is not affected by them. And it can be observed that the value of XRP is directly proportional to the total amount M of transactions processed by using XRP for cross-border payment every year, the total number N of cross-border payment transactions participated by XRP every year, and the number Y of users in the Ripple network.

If the market share of Ripple company cross-border payment business has increased, more cross-border payment businesses need to be conducted in XRP, which will directly lead to an increase in the total amount of transactions processed by using XRP for cross-border payment each year, which is reflected in the increase of M in the XRP pricing model ⑦. Therefore, the conclusion that the increase of M results in the increase of the value of XRP V is reasonable. If the total number of transactions involving in cross-border payment increases every year, on the one hand, it will lead to the acceleration of the consumption of XRP and the reduction of the number of XRP that can participate in cross-border payment. In the case of other variables unchanged, the decrease of the number of XRP will lead to the rise of its value. On the other hand, the increase of the total number of cross-border payment transactions participated in by XRP every year also reflects that more cross-border payment transactions need to be conducted by

XRP, which is also the embodiment of the rising use value of XRP. It is reflected in the increase of *N* in the pricing model of XRP⑦. Therefore, it is reasonable to conclude that the increase of *N* leads to the increase of *V* value. If the number of users in the Ripple network increases, on the one hand, it will lead to an increase in the number of XRP without liquidity, which will reduce the number of XRP that can participate in cross-border payment. In the case of other variables unchanged, the decrease of the number of XRP will lead to the rise of its value. On the other hand, the increase in the number of users in the ripple network also reflects that as a cross-border payment tool, XRP is used by more users, which is also the embodiment of the rising use value of XRP. This is reflected in the increase of *Y* in the pricing model ⑦. Therefore, the conclusion that the increase of *Y* leads to the increase of *V* value of the XRP is reasonable. In conclusion, the relationship between the independent variables and the dependent variables in the pricing model ⑦ of XRP can be reasonably explained, so the pricing model ⑦ of XRP is reasonable.

After setting up the pricing model, the data can be substituted to calculate the intrinsic value of the currency. In order to provide a good reference for the calculation of the value of XRP, this paper first considers an ideal use of XRP: (1) all cross-border payment transactions in the world need to be processed by RBD; (2)All XRP issued by Ripple can only be used as circulating currency and safe currency in the ripple network (open market transactions are not allowed). Under the ideal use condition of RBM, this paper selects the total amount of global cross-border payment from 2015 to 2018 as the value of m in formula ⑦, the total circulation quantity of XRP as the value of a in formula ⑦, the total number of global cross-border payments per year as the value of N in formula ⑦, and the relevant institutions with cross-border payment cooperation with XRP as the value of Y in formula ⑦. The internal value of the XRP is calculated as follows: (in the process of value calculation of the XRP, considering that there are more than 300 global customers of ripple company at present, only 6000 XRP play a role of safety protection, which can be ignored, that is, the pricing model of the Swiss currency is written as $v = M * t / [T * (A - N * k)])$.
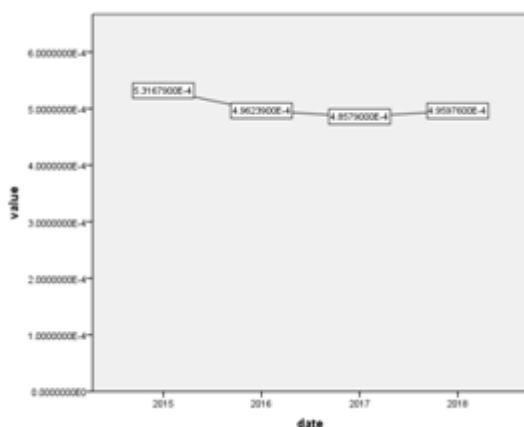

Figure 4: Value trend chart of XRP

According to the calculation, the intrinsic value of the XRP from 2015 to 2018 is about 0.05 cents, which is obviously

different from the market price of the XRP. Due to the fact that 100 billion XRP are not in full circulation at present, Ripple has also formulated the relevant policy of regular release of XRP. Therefore, with the increasing number of XRP, their intrinsic value will not rise significantly in a short period of time. The intrinsic value of the currency will increase significantly as long as the trading volume of the currency is increased after the whole investment.

3.3 Measurement of price bubbles in XRP

This paper introduces bubble degree to measure the price bubbles of XRP. The measurement model of XRP's bubble degree is:

$$B = (P - v) / v \ ⑧$$

B is the bubble degree of XRP, *P* is the market price of XRP, and *v* is the intrinsic value of XRP.

The market price data of XRP wave and the intrinsic value of the former XRP are substituted into the formula (8). From this we can see that XRP's bubble degree is as follows:
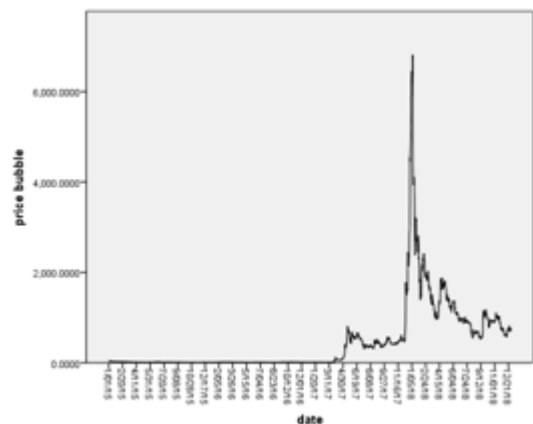

Figure 5: The price bubble chart of XRP

As shown in Figure 5, there is a long-term price bubble in XRP. Even at the lowest level in the history of XRP, there is a 6.69 fold bubble. And after 2017, there are thousands of price bubbles in XRP. With the sharp rise in the market price of XRP, its bubble has reached the highest point of 6813.8 times.

Summary statistics

Table 7

	N	Minimum value	maximum value	mean value
Foam degree	1461	6.6926	6813.8451	447.078521
Valid n	1461			

Summary statistics

Table 8

	skewness		kurtosis	
	Statistic	Standard error	Statistic	Standard error
Foam degree	3.405	.064	17.136	.128
Valid n				

From the descriptive statistics of the above two XRP's bubble degrees, we can see that there is a price bubble in the

long run, and its bubble degree has changed dramatically with the market price change of the XRP market. The average bubble rate of XRP is 447 times higher. The skewness coefficient of XRP bubble degree is 3.405, the bubble degree image is right deviation, and the kurtosis coefficient is as high as 17.136, so the bubble distribution of XRP is steeper than normal distribution.

The above calculation process is carried out under the most ideal use of the XRP. Due to the lack of specific data on Ripple's share of cross-border payment market, there is no way to calculate the actual use of XRP in cross-border payment. However, it is certain that the proportion of cross-border payment business using XRP is very small. In formula (7), the value of M in the actual situation is much smaller than that in the ideal situation. As a result, the actual intrinsic value of the XRP is also much smaller than the $0.05 we calculated in the ideal case. So the real bubble of XRP will be much higher than the above calculations.

3.4 Result analysis

Through the above research, no matter from the perspective of dynamic bubble process, or from the analysis of static foam components, there is a huge price bubble in XRP. The main reasons are as follows: (1) speculation causes the price of the currency to soar and plummet. Cryptocurrency, as a new thing, has great attraction to speculators in the market, and the XRP is no exception. There is no limit on the rise and fall, and the 24-hour trading system also facilitates speculation. (2) Ripple's intention is unclear. The company has indicated that its intention to issue XRP is to increase the liquidity of the network and make it the basic currency in the network. But Ripple has launched an open market offering (ICO) of the currency, which has become the company's main source of revenue. This behavior, which is bound to cause great changes in the price of the Swiss currency, is contrary to the willingness of the circulating currency with stable price. Therefore, Ripple's explanation of the market price of the XRP has a strong guidance.

4. Conclusions

This paper makes an empirical study on the price bubbles of XRP. First of all, the paper makes a descriptive statistical analysis of the market price of the XRP, and holds that the market price of the XRP market is soaring to a sharp decline, and the market price fluctuates greatly. Secondly, the pricing model of XRP is set up from the perspective of the value of use, and then the bubble degree of the XRP is measured. Finally, from the two aspects of dynamic bubble process and static foam composition, the conclusion is drawn that there exists price bubble in XRP money.

In addition, this paper argues that investors should try their best to avoid investing in the XRP. The reasons are as follows: (1) there is a big speculative bubble in the XRP and the risk of investment is large. (2) Ripple has a large number of XRP, and there has been a large number of sell-off resulting in a sharp decline in the market price of the XRP

market, and the possibility of continued selling. (3) The development prospect of Ripple is not bright, and now it includes the major finance such as Morgan chase and swift. Institutions have been involved in the field of cross-border payment based on blockchain technology, and Ripple has no strong core competitiveness. However, the market price of XRP is closely related to the development of Ripple.

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