Analysis of Bitcoin and Alternative Assets Based on VAR Model

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Abstract. This paper is based on April 2020 to July 2020 bitcoin price and s & p real assets index data, using the VAR model for dynamic identification, empirical analysis results show that the currency price is s & p real assets index, but s & p real assets index is not the currency price granger. At the same time, as can be seen from the pulse response chart, when the price of bitcoin is impacted by one unit, the S & P physical assets index will fluctuate greatly, close to 0 in stage 5, indicating that the price of bitcoin has an impact on the S & P physical assets index.

Keywords: Bitcoin; S & P physical assets index; VAR model

1 Introduction

With the development of The Times and the progress of the digital economy, represented by currency has risen, because COINS is the most valuable digital currency on the market, then it has scarcity and can be used for consumption and trading, so cryptocurrency advocates think that currency is digital gold.

The S & P Real Assets Index is the first index that measures global property and inflation-protected bonds through tradable and available listed stocks, bonds and futures components. Therefore, by studying the correlation between the two, we can observe the impact of bitcoin on the fluctuation of S & P physical assets index, which contributes to the development of digital currency.

Scholars have done a lot of research on cryptocurrencies. From the perspective of bitcoin attribute, Jia Liping (2013) [1] believes that bitcoin is a brand new anarchy virtual currency by analyzing the generation and operation mechanism and its currency attribute. Lai Yingying (2022) [4] compared bitcoin with the fiat currency and the central bank digital currency respectively, stressing that although both can be used to be traded, but their value measurement forms are very different.

Because Bitcoin has no legal value. So bitcoin risk may be related to a variety of factors. Yechen Zhu (2017) [5] uses monthly data from 2011 to 2016 to build VEC models to explore economic factors such as the dollar index, Dow Jones sound bitcoin

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prices. Through analysis, they found that all of these variables do have a long-term impact on the price of bitcoin. Liu Xiaofeng (2020)[2] analyzed the price influencing factors of bitcoin by establishing a V AR model, put forward the significance of the empirical research and theoretical research on digital virtual currency. Spyros Papathanasiou (2019) [3]uses quantitative data collection methods to point out that the public sees bitcoin as mainly a trading tool, different from what experts think it is an investment asset.

From the above research literature, we can conclude that although scholars have different disputes about the attributes of bitcoin, but the bitcoin market is constantly improving, and its price is affected by a variety of policy factors and indicators.

2 Representative Analysis and Descriptive Statistics

2.1 Feature analysis

Figure 1 shows the daily data chart of Bitcoin prices and the S & P Real Assets Index from April 2020 to July 2022, which are roughly the same under a combination of factors. Bitcoin prices fell in April 2021 after the rising trend is mainly due to the United States to raise capital gains tax rates to ease income inequality and countries are increasingly regulating, such as digital currency market fell sharply, then a sharp correction, and the s & p physical assets index still maintain an upward trend.

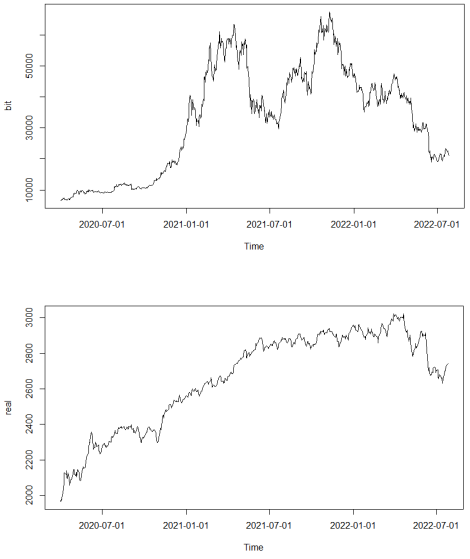


Fig. 1. Time sequence chart of the Bitcoin closing price and the S & P Real Assets Index (Original figure)

2.2 Descriptive statistics

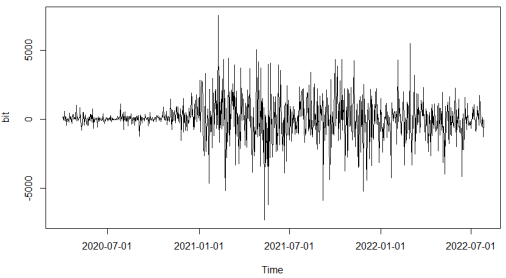
The table that the difference between the maximum and the minimum value of the bitcoin price and the S & P physical assets index is large, the standard deviation is large, indicating the data fluctuations during this period are relatively violent.

Table 1. Results of the V A R model parameter estimation (Original table)

variable	Bitcoin price	The S & P Real Assets Index	First-order price difference of bitcoin	The S & P physical assets index has a first-order difference
sample capacity	605	605	604	604
least value	6629.00	1965.10	-7311.50	-81.87
crest value	67527.9	3023.99	7542.80	54.82
average	32870.49	2659.34	9.27	1.28
median	35815.40	2736.24	29.15	1.96
standard error	17296.6	266.38	1568.9	15580.8
skewness	-0.034	-0.653	-0.121	-0.623
kurtosis	-1.271	-0.806	3.160	2.631

2.3 Stability test

Figure 1 shows that the raw data are volatile and through the data do first order difference can not change the nature of the data and correlation of the relationship at the same time can make the data more stable, so the original data for first order difference processing, get the sequence diagram shown in Figure 2.



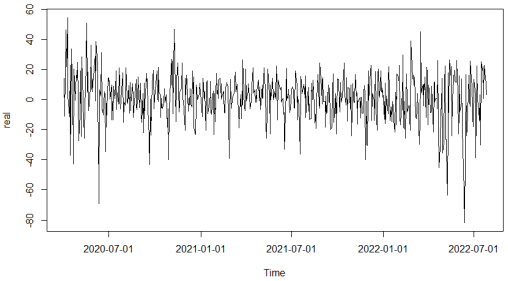


Fig. 2. Time sequence chart of the first-order difference between Bitcoin's closing price and the S & P Physical Asset Index (Original figure)

After the first-order difference between the two, the ADF unit root test shows that the T statistic is at 5%, and the p-value of bitcoin and S & P physical assets index are respectively

Table 2. The A D F test (Original table)

ADF checkout	p price	result
Bitcoin's closing price after the first-order difference	0.01	refuse
The S & P Real assets index after the first-order difference	0.01	refuse

We get the first order effect of the original data sequence difference by ndiff through the () function in R language. As shown in Table 1, it is less than 0.05, indicating that the first order difference sequence of the original sequence is a stationary time series.

3 Empirical Analysis

3.1 Data sources

This paper uses the data from April 2020 to July 2022 provided by Yingwei.com for research. A previous study has found a dynamic correlation between bitcoin prices and the S & P physical assets index. To accurately analyze the intrinsic connection between them, we explore the dynamics by constructing a VAR model. Let the price of Bitcoin be BTC and the S & P Physical Assets Index be REAL, and the model results are as follows:

In the model, t represents the time, ω represents the lag order of bitcoin, REAL represents the S & P physical assets index, and C represents the constant and the error term of the equation. R builds the VAR model with the bitcoin price BTC and the S & P Physical Assets Index REAL.

$$BTC_t=C+\Phi_1 BTC_{t-1}+\Phi_2 BTC_{t-2}+\ldots+\Phi_i BTC_{t-i}+\theta_1 REAL_{t-1}+\theta_2 REAL_{t-2}+\ldots+\theta_j REAL_{t-j}+\omega_1 \quad (1)$$

$$ETH_t=C+\Phi_1BTC_{t-1}+\Phi_2BTC_{t-2}+\ldots+\Phi_iBTC_{t-i}+\theta_1REAL_{t-1}+\theta_2REAL_{t-2}+\ldots+\theta_jREAL_{t-j}+\omega_2 \quad (2)$$

3.2 Root of unit test and choice of lag order

BVAR model time series regression is suitable for trend smoothing process, so the currency price and the s & p physical assets index time series unit root test, this study chose the ADF and PP test to test the smoothness of the sequence, test results are shown in the table below.

Table 3. Results of the unit root test for the sequences of primary variables and their first-order difference sequences (Original table)

variable	ADF checkout	PP checkout	conclusion
BTC	-0.8285	-2.4602	not go
	0.9591	0.9555	
REAL	-0.7166	-5.1391	not go
	0.9691	0.8231	
dBTC	-8.6147	-909.03	pass through
	0.01	0.01	
dREAL	-8.1921	-481.16	pass through
	0.01	0.01	

The test results show that the original variables all have the unit root, while the variables after the first-order difference have no unit root, so the sequence variable after the first-order difference is smooth. A VAR model can be established to explore the dynamic relationship between the price fluctuations of the two, and the lag term of the model is determined by the AIC criterion as 1.

3.3 Results of the VAR model regression results

The parameter estimation results of the VAR (5) model are shown in the table. From the results, we can see that some variables in the model may have multicollinearity, and the significance level of the regression coefficient is not high. But from the overall regression results, there was some correlation between the two variables.

Table 4. Parameter estimation results (Original table)

VAR								
	Model1		Model2		Model3		Model4	
explanatory variable explained variable variable	real	bit	real	bit	real	bit	real	bit
real.l1	0.1585*** (0.0001)	1.5032 (0.722)	0.1677*** (0.01)	2.2369 (0.595)	0.1730*** (0.01)	2.3397 (0.576)	0.1734*** (0.01)	2.2728 (0.587)
bit.l1	0.00006 (0.1118)	-0.0564 (0.177)	0.0007. (0.0919)	-0.0532 (0.203)	0.0007. (0.0943)	-0.0542 (0.194)	0.0007. (0.0962)	-0.5326 (0.202)
const	3.4537** (0.0063)	199.0215 (0.125)	1.0410. (0.0967)	6.6529 (0.917)	--	--	--	--
trend	-0.0079* (0.0280)	-0.6317. (0.088)	--	--	0.0006 (0.7195)	-0.1381 (0.451)	--	--
R-Squared	0.0409	0.0027	0.0347	0.0005	0.0352	-0.0012	0.0366	-0.0005
F-statistic	9.551	1.541	11.83	0.8483	8.334	0.7588	12.45	0.8542

3.4 The Granger causality test

By Granger causal test results, in the bitcoin price is not the s & p real assets index reason, the p value of 0.034, less than 0.05. Test results, so at 5% level can reject the original hypothesis, accept the bitcoin price is Granger reason alternative hypothesis is much more than 0.05, so the s & p real assets index is not bitcoin price reason cannot be rejected at 5% level again.

Conduct a Granger causality test on the price of Bitcoin and the S & P Physical Assets Index to explore whether there is a short-term guidance relationship between them. The test results are shown in the table below.

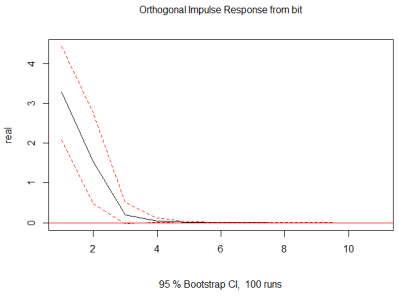
Table 5. Granger causality test results (Original table)

The original hypothesis	Lagging order	F -Test	p	conclusion
B TC is not real	5	2.5361	0.034	refuse
Real is not BTC Granger reason	5	0.1271	0.718	accept

3.5 Pulse response analysis

Since the S & P physical assets index is not a Granger causal relationship, this paper only needs to analyze the fluctuation range of the S & P physical assets index when the bitcoin price is hit by the unit impact. The pulse response map is as follows.

According to the pulse response map, the price of bitcoin disturbance to the S & P physical assets index is maximized in the first cycle, and is minimized in the fifth cycle. The S & P physical assets index disturbs itself the most in the first cycle, starts to approach zero around the fifth cycle.



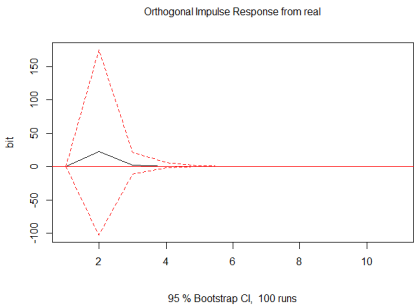


Fig. 3. Orthogonal Impulse Respones (Original figure)

4 Conclusion

The empirical analysis results show that there is a one-way Granger causality between the two, so the change in the price of bitcoin can affect the change of the S & P physical assets index.

This may be because Bitcoin is one of the largest and influential cryptocurrencies so far. Due to a large number of transactions in the market, the currency slowly become an alternative assets, in this paper we study the standard & p physical assets index is a kind of alternative assets, therefore, the price of the currency changes may affect other alternative assets. But because Bitcoin is the leader in cryptocurrencies, and its price fluctuations are affected by many objective factors, the fluctuations in the S & P physical assets index will not affect the price volatility of bitcoin in the short term.

The COVID-19 epidemic has had a significant impact on the world economic pattern, leading to the increasing demand and risks for the reality of digital currencies. Cryptocurrencies, led by bitcoin, fell and then rose in the early days of the pandemic and hit all-time highs, possibly because they were more attractive to investors during the crisis. Historically, real-asset stocks have resisted inflation and dispersed their portfolios, reducing profit losses by changing the portfolio of alternative investments during inflation periods, and so the S & P physical assets index data have not been significantly affected during the pandemic.

To sum up, this paper by establishing the VAR model, discusses the correlation between the cryptocurrency currency price and s & p physical assets index, empirical analysis shows that the price of the currency changes may affect the fluctuation of s & p physical assets index, so investors can choose reasonable alternative portfolio based on this feature.

References

1. Jalipin. The Theory, Practice, and Impact of Bitcoin [J]. International Finance Research, 2013 (12): 14-25.

2. Liu Xiaofeng. An Empirical Study on the Impact Factors of Digital Currency Price [D]. Shandong University, 2020.
3. Spyros Papathanasiou and Nikolaos Papamatthaiou and Dimitrios P.Balios.Bitcoin as an alternative digital currency: exploring the publics' perception vs.experts [J].International Journal of Financial Engineering and Risk Management, 2019, 3(2)
4. Lai Yingyi. COINS analysis [J]. Journal of cooperation in economy and technology, 2022 (15): 58-61. DOI: 10.13665 / j.carol carroll nki hzjjykj. 2022.15.007.
5. Yechen Zhu, David Dickinson, Jianjun Li. Analysis on the influence factors of Bitcoin's price based on VEC model[J]. Financial Innovation,2017,3(1).
6. Xu Liming, Li Jing. An Empirical study of the spillover effect of the Chinese and American Bitcoin market [J]. Statistics and Decision Making, 2016(13):156-159.
7. Li Cheng, Ma Guoxiao. Application of VaR Model in Interbank lending market in China [J]. Financial Research, 2007 (05): 62-77.