Proceedings of the 4th International Conference on Business and Policy Studies
DOI: 10.54254/2754-1169/2025.29773

The Report of Research of Cryptocurrency Situation During Pandemic Period

Haoyi Yin[1*], Yuhang Zhou[2], Wenxuan Zheng[3]

[1]BBA Program in Management and Finance, University of Toronto, Toronto, Canada
[2]School of Economics and Finance, Chongqing Finance and Economics College, Chongqing, China
[3]Department of Business Administration, Zhongnan University of Economics and Law, Wuhan, China
**Corresponding Author. Email: krystalyb@163.com*

Abstract. This paper analyzes the behaviors of four major cryptocurrencies—Bitcoin, Monero, Dogecoin, and Ripple—over two periods: during the COVID-19 pandemic (March 2020 to May 2023) and the post-pandemic phase (June 2023 to August 2024). Using historical price data, the study examines volatility, price trends, and risk levels. Tools like Q-Q and P-P plots were used to assess how well the price data fits standard distributions, highlighting potential risks in the tails, especially for Bitcoin and Ripple. The Value at Risk (VaR) model, supported by Kupiec's test, effectively predicted risk across the cryptocurrencies, though Dogecoin exhibited sharp price movements due to speculative surges. The results highlight the need for risk models that account for the distinct behaviors of each cryptocurrency, particularly during periods of market instability.

Keywords: Cryptocurrency, COVID-19 Pandemic, Price Volatility, Risk Assessment

1. Introduction

The research is aimed to study the price volatility of cryptocurrency using a mathematical model during the COVID-19 pandemic. The currencies we chose are Bitcoin, Monero, Dogecoin, and Ripple. The time we selected is from March 2020—May 2023—August 2024. The general reason we choose these two time periods since countries imposed strict measures to contain the spread of the virus in January 2020, and the World Health Organization has issued an official statement saying the outbreak is over in May 2023 [1].

We collected and organized relevant data on the cryptocurrency market, including prices, trading volumes, and market capitalization. Establishing a risk assessment model for the cryptocurrency market to assess the risk levels of different cryptocurrencies. Also providing reasonable investment suggestions for investors and references for regulatory agencies to formulate effective regulatory policies.

The report shows a detailed statistical analysis of a cryptocurrency, including market characteristics, price fluctuation patterns, and risk assessment. Establish a risk assessment model and price prediction model for the cryptocurrency market. And we publish relevant academic papers. Providing scientific decision-making bases for investors and regulatory agencies. It helps to deeply

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understand the operating mechanism of the cryptocurrency market and provides more scientific investment decision-making bases for investors. It also promotes the development of financial technology and provides new impetus for the development of the digital economy [2].

2. Literature review

The Selected data from historical global price indicators of cryptocurrencies represent prices across multiple exchanges. The selection data time is from August 2014 to the end of February 2017. There are seven cryptocurrencies were selected for analysis which are Bitcoin, Dash, LiteCoin, MaidSafeCoin, Monero, Dogecoin, and Ripple. In the article, the researcher uses Q-Q plots, P-P plots, Goodness of Fit Tests, VaR and ES Plots, Kupiec's test, and Dynamic Volatility to try to find For each cryptocurrency, their best-fitting distribution type is listed in the table [3].

The yield distribution characteristics and tail behaviors of the seven cryptocurrencies reveal the complexity and high-risk characteristics of the cryptocurrency market, especially in terms of the diversity of tail distribution. The VaR and ES of cryptocurrencies differ significantly at different confidence levels, reflecting the risk characteristics of different cryptocurrencies. Compared to traditional financial assets, the market risk of cryptocurrencies is more complex and difficult to predict [4].

Most cryptocurrencies exhibit a heavy-tail distribution relative to the US dollar, which means that they have large extreme value fluctuations. And there is no single distribution that provides the best fit for all cryptocurrency data. Different cryptocurrencies require different distributions to better fit their exchange rate data as the article had mentioned. These results have important implications for risk management (such as calculating value at risk VaR) and investment decisions [5].

3. Data and method

The data employed in this study comprises historical global price indices of cryptocurrencies obtained from www.marketwatch.com. For analysis, two distinct time periods were selected: March 2020 to May 2023 and June 2023 to August 2024. The first period begins on March 1, 2020, marking the early phase of the global COVID-19 pandemic, a time when many countries imposed strict lockdowns to mitigate the virus's spread. This period saw profound disruptions across global economies, with the cryptocurrency market experiencing notable volatility. The cut-off date of May 2023 coincides with the World Health Organization's (WHO) official declaration on May 5, 2023, that COVID-19 no longer constituted a "Public Health Emergency of International Concern" (PHEIC), effectively concluding the three-year pandemic emergency. In this research, four major cryptocurrencies were analyzed: Bitcoin, Monero, Dogecoin, and Ripple. Below is a summary of the daily exchange rate statistics for these cryptocurrencies.

Bitcoin: Under the alias Satoshi Nakamoto, the release year was 2008 and 2009. Bitcoin stands as the premier and most renowned form of digital currency. The integration of blockchain technology in decentralized government bonds enables trading among peers, bypassing intermediaries like banks. Bitcoin, a digital asset, is housed in a digital wallet available for access through computers or smartphones. Capate of buying goods and services, though suppliers accept them. Bitcoin's fundamental attributes, namely its decentralization, unchangeability, openness, and safety, have encouraged research into decentralized finance (DeFi) and various blockchain applications across numerous sectors.

Monero: Monero, a cryptocurrency focused on privacy, employs sophisticated encryption methods, encompassing circular signatures and addresses that conceal transaction information and

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user IDs. Monero has enhanced its unique privacy functionalities, setting it apart from other cryptocurrencies and attracting those who opt for anonymity. Upgrades to CryptoNote's essential protocol are underway to minimize vulnerabilities and bolster its resilience against blockchain analysis threats. Nonetheless, notwithstanding those privacy benefits, the Monero dollar continues to encounter substantial regulatory hurdles. The growing worry about illicit activities stems from a need to maintain anonymity.

Dogecoin: Initially created in 2013 to satirize Bitcoin, Dogecoin has since transformed into a cryptocurrency driven by community interest. Litecoin's coding repository adopts the Scrypt mining algorithm, known for its GPU expertise and support for decentralized attributes. Dogecoin handles every minute, while Bitcoin accelerates the process and accelerates transactions. Minimal transaction expenses and quick processing are ideal for microtransactions, digital chips, and philanthropic contributions. Being an open-source initiative, open coins foster innovation and progress, drawing in developers and passionate individuals from various backgrounds.

Ripple: Ripple, a platform in financial technology, offers quicker and more economical methods for enhancing international payments and remittances. The fundamental cryptocurrency XRP acts as a connecting currency within the Ripple network, facilitating rapid and cost-effective exchanges among different fiat currencies. Ripple employs the Ripple Protocol Negotiation Algorithm (RPCA) to guarantee efficient transaction processing and reduced latency. In the face of regulatory oversight, Ripple has formed alliances with numerous global financial entities and payment services to enhance the efficiency of international transactions.

Tables 1 and 2 provide a summary of the exchange rate statistics for these four cryptocurrencies across the two selected periods.

Table 1 shows the exchange rate data spanning from March 2020 to May 2023, illustrating the performance and worth of each digital currency in this timeframe. Significantly, Bitcoin, being a conventional cryptocurrency, exhibited a broad spectrum of prices and considerable instability, characterized by a positively skewed distribution, suggesting prices often exceed the average. The significant skewness and kurtosis in Dogecoin and Ripple suggest marked price fluctuations, probably influenced by the dynamics of speculative trading. Conversely, Monero exhibited steadier traits, characterized by a reduced standard deviation and a moderate degree of kurtosis, suggesting a steadier base of users and a steadier market standing [6].

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Table 1. Summary statistics of daily exchange rates of Bitcoin, Dogecoin, Ripple, Monero and Ripple, versus the U.S. Dollar from 1 March 2020 until 1 May 2023

Statistics	Bitcoin	Dogecoin	Ripple	Monero
Minimum	4106.980957	0.001	4.15	26.2
Q1	17012.97998	0.003175	9.22	126.44
Median	27846.49512	0.05675	13.245	156.23
Mean	29491.30158	0.054636111	16.76192308	170.3709615
Q3	42018.94043	0.0798	22.8275	219.1875
Maximum	68789.625	0.4505	60.5	517.48
Skewness	0.479719636	3.093366144	1.459424478	1.144158285
Kurtosis	-0.723111066	15.65253743	2.33468999	2.582938613
SD	16059.30802	0.06289337	10.47794822	79.32362091
Variance	257901374.2	0.003955576	109.7873989	6292.236835
CV	0.544543888	1.15113189	0.625104182	0.465593551
Range	64682.64404	0.4495	56.35	491.28
IQR	25005.96045	0.076625	13.6075	92.7475

Table 2 scrutinizes identical cryptocurrencies in their second phase, spanning June 2023 to August 2024, underscoring significant disparities. Bitcoin and Monero persistently exhibited broad price spectrums, highlighting ongoing instability. Dogecoin demonstrated the greatest level of skewness and kurtosis, indicative of a distribution that was significantly non-normal, marked by pronounced price highs. Ripple, on the other hand, demonstrated lower volatility and a reduced coefficient of variation. These observations illustrate the varying levels of price fluctuation and statistical behavior across different cryptocurrencies.

Table 2. Summary statistics of daily exchange rates of Bitcoin, Dogecoin, Ripple, Monero, Ripple and Ethereum, versus the U.S. Dollar from 1 June 2023 until 1 August 2024

Statistics	Bitcoin	Dogecoin	Ripple	Monero
Minimum	24797.16797	0.0555	11.25	99.34
Q1	29672.81348	0.07075	14.1925	142.035
Median	42072.18946	0.08875	15.76	155.26
Mean	45484.57266	0.104273333	16.23683333	152.4223333
Q3	61175.64258	0.123125	17.79	167.47
Maximum	73750.07031	0.229	24.07	182.22
Skewness	0.297249244	1.283227264	0.687178112	-0.727549601
Kurtosis	-1.463976908	1.146883233	0.359823295	-0.023523377
SD	16634.20077	0.0443206	2.496388233	19.06967567
Variance	276696635.2	0.001964316	6.231954209	363.6525301
CV	0.365710829	0.425042513	0.153748467	0.125110771
Range	48952.90234	0.1735	12.82	82.88
IQR	31502.8291	0.052375	3.5975	25.435

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To sum up, the statistical analysis reveals the distinct characteristics of cryptocurrency markets during the COVID-19 pandemic. While certain cryptocurrencies experienced extreme volatility and price spikes, others maintained more stable distributions. These findings underscore the necessity of considering the unique attributes of each cryptocurrency when evaluating its performance and associated risks, particularly during periods of heightened economic uncertainty.

The method we choose to use is three statistic graphs in the article mentioned and described. These are the P-P plot, Q-Q Plot, and Kupiec's test. During the graphing of Q-Q and P-P plots two, we applied the result of the article, which is each cryptocurrency best fitting distribution

Table 3. Best fitting distribution for each cryptocurrency

Cryptocurrency	Best Fitting Distribution
Bitcoin	Generalized hyperbolic
Dogecoin	Generalized t
Monero	Normal inverse Gaussian
Ripple	Normal inverse Gaussian

3.1. Q-Q plot

This is used to compare the distribution and to examine whether the data fits with one certain distribution. Based on the result of the article know the best fitting distribution for each type of cryptocurrency. So, we used the corresponding distribution and daily log return to graph it. If appear tail shift appears the return rate if skewed and has extreme benefit/loss value coming out.

3.2. P-P plot

This plot is used to visualize the sample and the theoretical distribution. This is mostly showing the relationship between ECDF and CDF. The ECDF means the probability of data less or equal to some setting number, and CDF means the probability of theoretical model expectation in a certain setting number. If the plot has been shifted, it means some of the sample data exists more higher or lower expectation values, and during the period happens about extreme events cause that to happen.

3.3. Kupiec's test

This is a test that helps to evaluate the risk expectation of the financial model, and we use the 99%VaR (value at Risk) to test the accuracy. As fewer samples are out of the line of 99%VaR which means there are some aberrant events which make a huge influence on the market. Only a few of these outliers coming out is normal, but if there are a lot of outliers means the model or sample data is inaccurate, and we need to rebuild the model or find new sample data.

4. Result

4.1. Q-Q plot

Bitcoin fits the distribution model, and only a few slight points are not on the line, which means only a few extreme losses and benefits happen. Dogecoin is following the trend of the distribution, and they are around the line trend not fit the line exactly. Both Monero and Ripple also fit the trend of the lines, but the tails are slightly shifted a little which also means they're got some influence.

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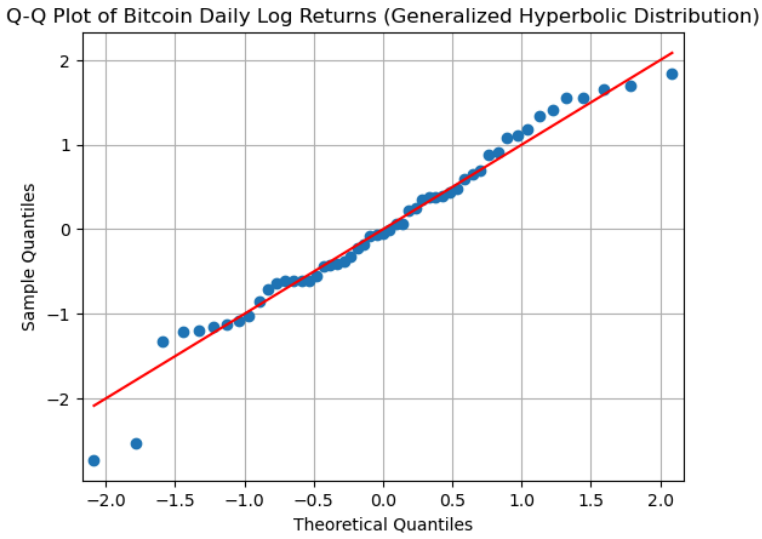

Figure 1. Q-Q plot of Bitcoin daily log returns (generalized hyperbolic distribution)

Figure 1 shows that the sample data falls on a straight line so the Bitcoin Daily Log Returns follow a generalized hyperbolic distribution

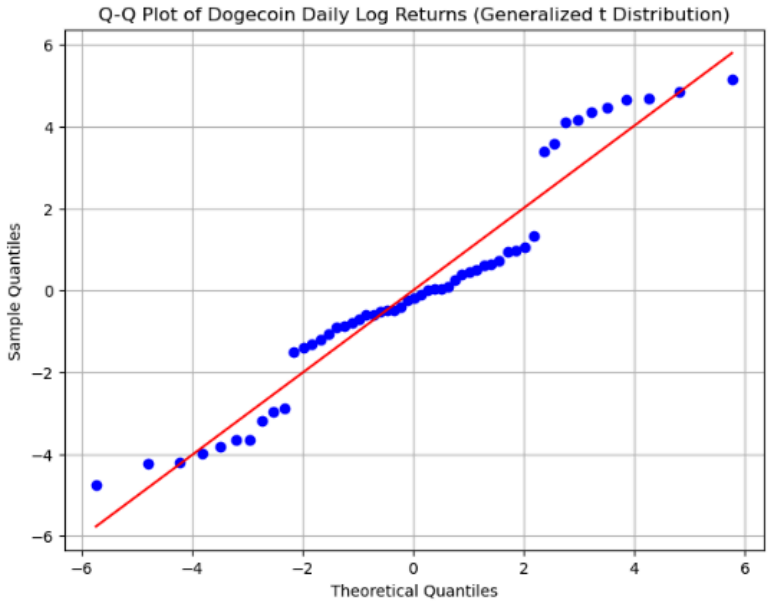

Figure 2. Q-Q plot of daily log returns(generalized t distribution)

Figure 2 shows that the sample data do not fit well into the linear distribution so the Daily Log Returns do not match the generalized hyperbolic distribution

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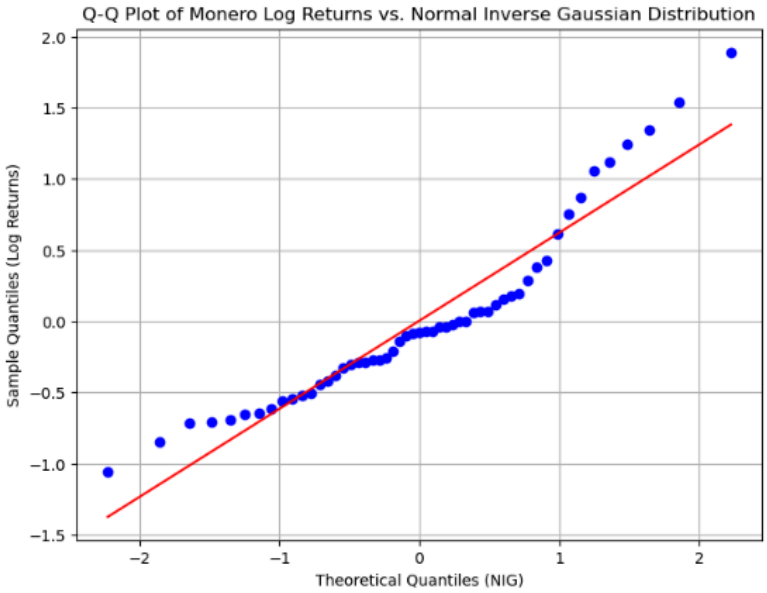

Figure 3. Q-Q plot of Monero log returns vs. normal inverse gaussian distribution

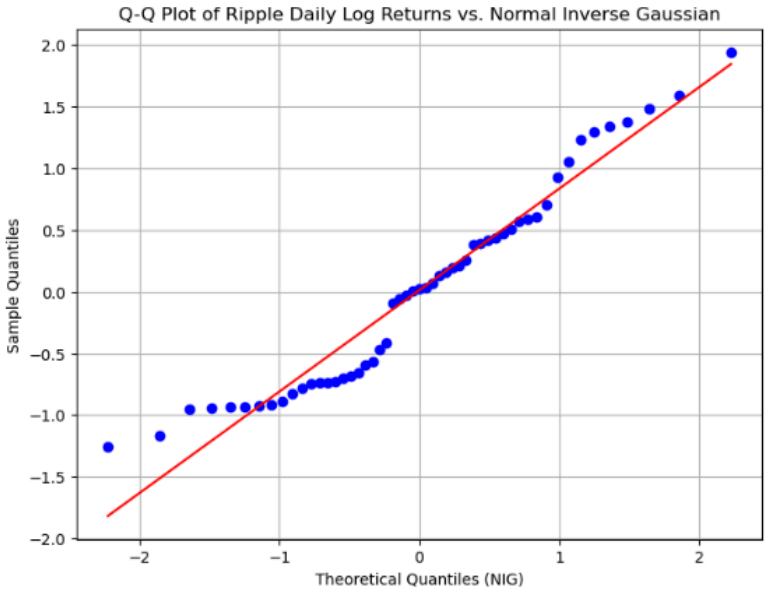

Figure 4. Q-Q plot of Ripple daily log returns vs. normal inverse gaussian

4.2. P-P plot

Bitcoin shows down tail shift only in the graph which means it has a risk would loss. However, the dogecoin displays the discontinuity line which means some gap between most of the sample data, but still following with the line trend. The Monero also mostly fits with the trend of the line but with some middle shifts, there is not too much. The ripple shows a down tail shift which means it would have a higher risk of facing loss.

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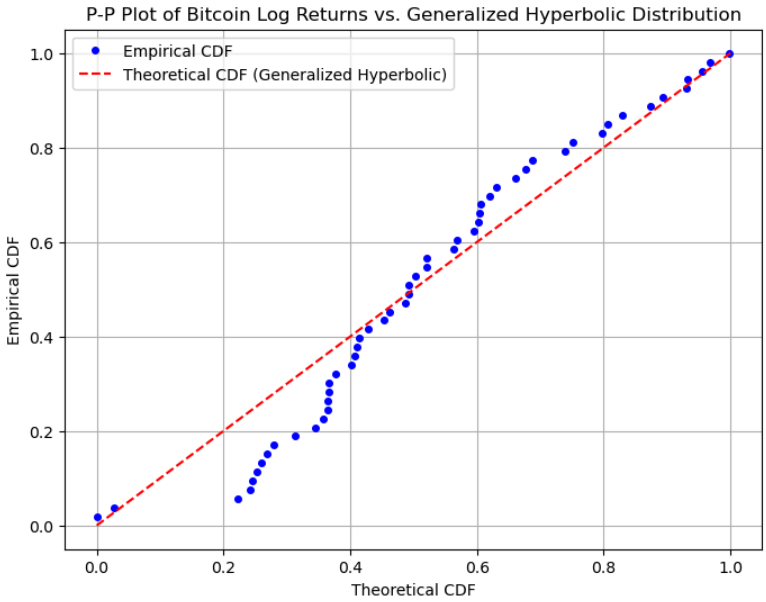

Figure 5. P-P plot of Bitcoin log returns vs. generalized hyperbolic distribution

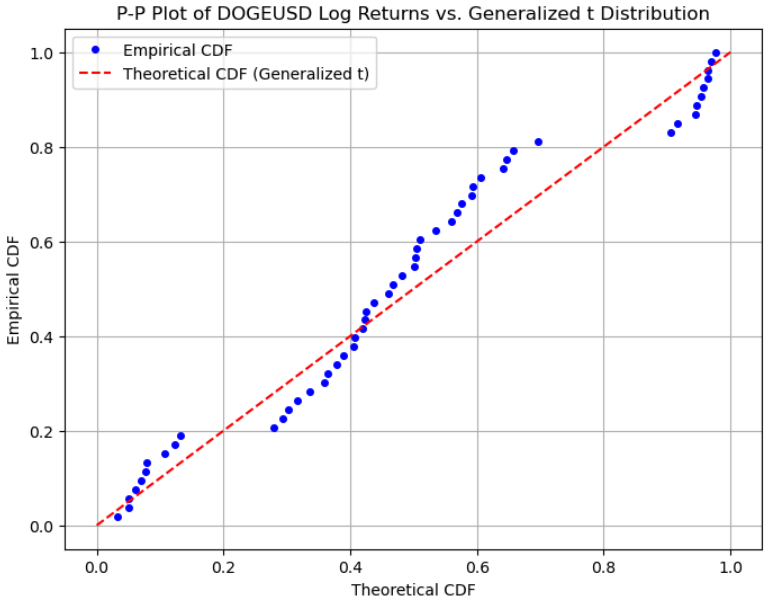

Figure 6. P-P plot of DOGEUSD log returns vs. generalized t distribution

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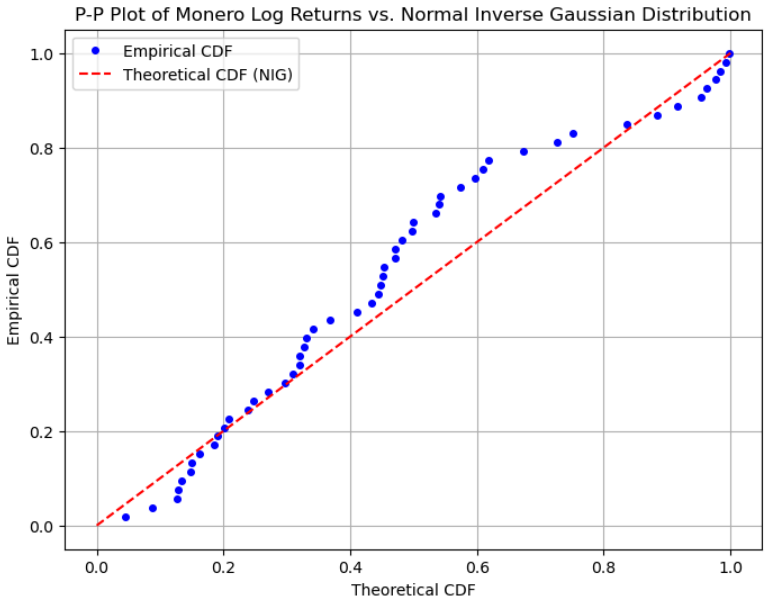

Figure 7. P-P plot of Monero log returns vs. normal inverse gaussian distribution

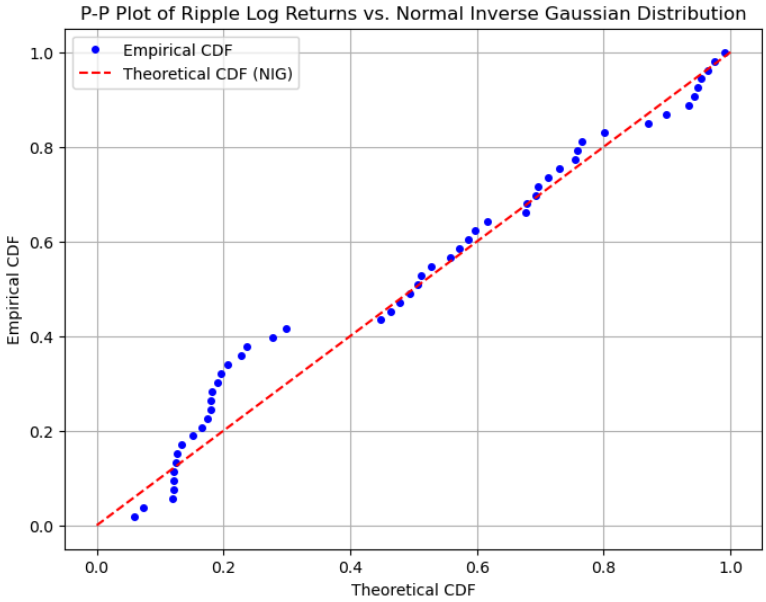

Figure 8. P-P plot of Ripple log returns vs. normal inverse gaussian distribution

4.3. Kupiec's test

The result of Kupiec's Test only shows one outlier, which means the evaluation model of VaR is accurate and we can be easier to evaluate the risk of these coins.

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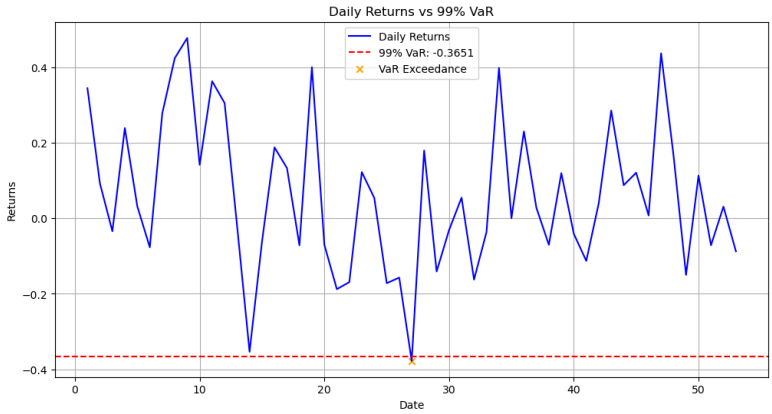

Figure 9. Daily returns vs. 99% VaR(-0.3651)

Figure 9 shows that there is a 1% probability of a loss of more than -0.3651 between days 20 and 30

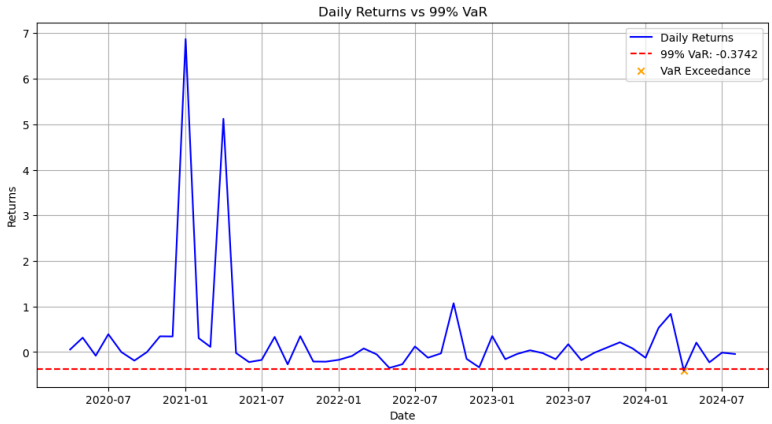

Figure 10. Daily returns vs.99% VaR(-0.3742)

Figure 10 shows that there is a 1% probability of a loss of more than -0.3742 between 2024-01and 2024-07

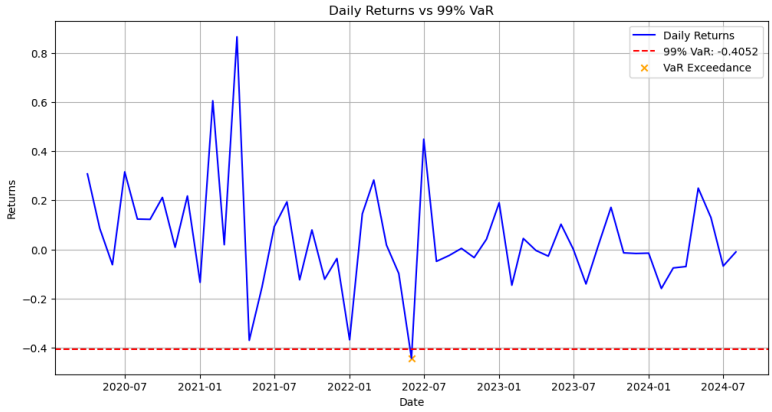

Figure 11. Daily returns vs.99% VaR(-0.4052)

Figure 11 shows that there is a 1% probability of a loss of more than -0.4052 near 2022-07

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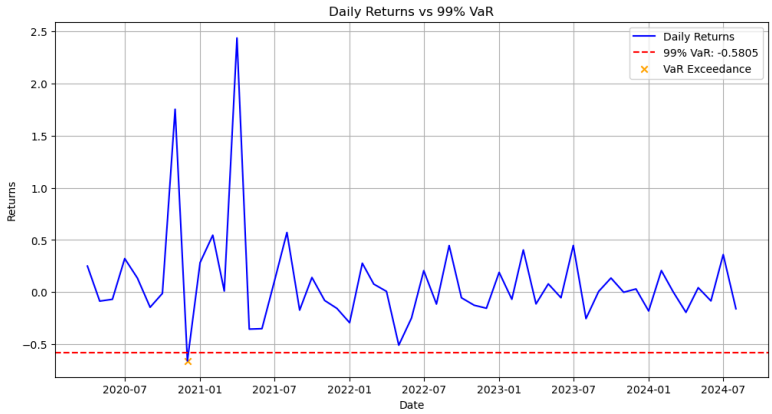

Figure 12. Daily returns vs.99% VaR(-0.5805)

Figure 12 shows that there is a 1% probability of a loss of more than -0.5805 near 2021-01

5. Conclusion

For different types of cryptocurrencies, we should use different distributions to make the expectation and we can know from the result that Bitcoin and Monero are more stable. For investment advice, using the VaR model to evaluate the risk is a good choice since this method is suitable for most cryptocurrencies. For Dogecoin still not so recommended to invest since the fluctuation and factors to complicated and hard to expect.

Acknowledgement

Haoyi Yin, Yuhang Zhou, and Wenxuan Zheng contributed equally to this work and should be considered co-first authors.

References

[1] Chan, S., Chu, J., Nadarajah, S., & Osterrieder, J. (2017). A Statistical analysis of Cryptocurrencies. Journal of Risk and Financial Management, 10(2), 12. https: //doi.org/10.3390/jrfm10020012

[2] Corbet, S., Larkin, C., Lucey, B., & Yarovaya, L. (2018). Cryptocurrencies as a financial asset: AsystematicanalysisInternationalReviewofFinancialAnalysis, 62, 182-199. https: //doi.org/10.1016/j.irfa.2018.06.004

[3] Dyhrberg, A. H. (2016). Bitcoin, gold and the dollar—A GARCH volatility analysis. Finance Research Letters, 16, 85-92. https: //doi.org/10.1016/j.frl.2015.11.004

[4] Katsiampa, P. (2017). Volatility estimation for bitcoin: A comparison of GARCH models. Economics Letters, 158, 3-6. https: //doi.org/10.1016/j.econlet.2017.05.004

[5] Kristoufek, L. (2015). What are the main drivers of the bitcoin price? Evidence from wavelet coherenceanalysis. PLoS ONE, 10(4), e0123923. https: //doi.org/10.1371/journal.pone.0123923

[6] Liu, Y., & Tsyvinski, A. (2018). Risks and returns of cryptocurrency. NBER Working Paper No. 24877.