The Effects of the COVID-19 Pandemic on CAPM Reliability in the Financial Sector

Chongling Chen *

New Channel, Hangzhou, 310000, China

* Corresponding Author Email: lucy.chen29@outlook.com

Abstract. The Capital Asset Pricing Model (CAPM) is a basic part of financial theory, but its real-world validity—particularly in China's stock market—remains debated. Due to reasons like government policy regulation and different composition of investors by type. This study examines the financial industry using monthly data for 71 sector stocks and 1,498 market stocks from the Shanghai Stock Exchange. Perform the regression to estimate beta and alpha coefficients. Compare two periods: the peak of the COVID-19 pandemic in 2020 and the period after the pandemic in 2024. The result shows that during the pandemic, the CAPM model fits both the market and the industry well, showing significant beta coefficients, minimal alpha coefficients, and strong explanatory power. After the pandemic, the model still applies to the financial sector—now with all portfolio beta coefficients above 1—but its relevance to the broader market diminishes. The study discusses how COVID-19 pandemic influences the financial sector, analyses the value of the use of the CAPM model under certain market circumstances.

Keywords: CAPM, COVID-19, financial industry.

1. Introduction

Over the past few years, the COVID-19 pandemic has profoundly impacted the global economy and financial industry. The market has been more volatile, the emotion of the investor sentiment and risk structure across industries has also been shifted. In the Chinese market in particular, the pandemic not only changed the risk perception of the investors, but challenges the validity of the CAPM in extreme market conditions as well. Although previous research has broadly covered whether the CAPM was valid in China's market during the pandemic period, only a few studies have compared its validity before and after the pandemic, particularly within the financial sector, which is highly sensitive to risk. This study aims to address this research gap.

This study seeks to estimate the systematic risk and test the effectiveness of the CAPM model across crisis and recovery phases. Evaluate whether the CAPM model remains consistent under abnormal market conditions by comparing the performance of the CAPM model in 2020 and 2024. Try to find the variations in the model's fitness and reliability over time by constructing portfolios. The study offers insights for investors and firms on how external shocks will influence the applicability of the classic pricing model. Besides, it provides practical evidence to fill the gap in the analysis of the CAPM validity across different periods, particularly within Chinese stock market.

The study applies the CAPM to both the financial industry and the overall market in 2020 and 2024. Stock returns, market returns, and the risk-free rate are collected to estimate beta and alpha coefficients through regression. Portfolios are then formed according to the descending beta values, which clearly reflect systematic risk. By comparing the two periods, the study evaluates the effectiveness of the CAPM. The paper is divided into four parts: the literature review, methodology, results, and conclusion.

2. Literature Review

The CAPM, proposed and refined by Sharpe, Lintner, and Mossin, is one of the fundamental theories in finance. It establishes a linear relationship between the systematic risk (the beta coefficient) and the expected returns, assuming a valid market, rational investors, and no information gap.

However, many empirical studies show that the effectiveness of the CAPM model varies with markets and times [1-3].

Black, Jensen and Scholes stated that the CAPM model works only in part for some developed markets [4]. While Fama and French highlighted that the beta coefficient cannot explain all the return variation, they introduced the multi-factor model, incorporating the size and book-to-market ratio factors [5-6]. This indicates that although the CAPM model is straightforward, it has limitations in explaining asset returns.

Scholars have reached different conclusions when testing the effectiveness of the CAPM model in China's market. Jin and Liu demonstrated that stock returns are influenced by factors beyond systematic risk, and the link between returns and the beta coefficient tends to be non-linear [7]. Wang and Di Iorio argued that government intervention and the irrational behaviour of individual investors can further weaken the role of systematic risk [8]. Meanwhile, Xu and Zhang observed that the Shanghai stock market shows results partly align with the CAPM model, suggesting that returns are linearly related to systematic risk [9].

In a particular industry, Qin and Yang used the estimated beta coefficients and portfolios in the pharmaceutical industry and the market in China to test the effectiveness of the CAPM model during the COVID-19 pandemic [10]. This research has not covered how the CAPM model performs after the pandemic and in other industries.

It is noticed that while research has examined the applicability of the CAPM model, there is a lack of empirical studies comparing China's financial industry during and after the pandemic. This study, based on financial industry data from 2020 and 2024, aims to find out the changes in the stability and explanatory power of the CAPM model in response to the pandemic.

3. Methodology

The study compares the performance of the market and the financial industry during two periods: the outbreak in 2020, and the post-pandemic period in 2024. The Shanghai Stock Exchange (SSE) was selected as the market. A total of 71 financial industry stocks were chosen, along with 1498 stocks in the market. The closing prices of these stocks and the SSE at the end of each month are analysed. All the data are from WIND [11]. To represent the risk-free rate, the yield of a one-year government bond was chosen due to its low credit risk, high liquidity, and short maturity. It effectively reflects the market's risk-free return level. The source of the data is Investing [12].

The data obtained are imported into the regression model [13]:

$$R_{it} - R_{ft} = \alpha_i + \beta_i\left(R_{mt} - R_{ft}\right) + \varepsilon_{it} \tag{1}$$

Where:

R_{it} is the return on stock i at time t

R_{ft} is the risk-free rate at time t

R_{mt} is the return on the market portfolio at time t

β_i is the systematic risk

α_i is the abnormal return

ε_{it} is the random error term at time t

After performing the regression, the beta coefficients for all stocks are estimated. Then organize them in descending order based on their beta coefficients in 2020 to form portfolios. For the market, 1375 stocks are selected, divided into portfolios of 25 stocks each; for the industry, 70 stocks are selected, with 10 stocks per portfolio. The first portfolio always contains the highest beta coefficients, while the last contains the lowest.

Then we calculate the average return for each portfolio, and estimate the beta coefficient for each of them using the regression model:

$$R_{pt} - R_{ft} = \alpha_p + \beta_p\left(R_{mt} - R_{ft}\right) + \varepsilon_{pt} \tag{2}$$

Where:
R_{pt} is the return on portfolio p at time t
β_p is the systematic risk
α_p is the abnormal return
ε_{pt} is the random error term at time t
In this step, we assume that all stocks in the portfolio have equal weights.
After this, we analyse whether the systematic risk and expected return are linearly related using the equation:

$$R_p = \gamma_0 + \gamma_1 \beta_p + \varepsilon_p \quad (3)$$

Where:
R_p is the average return on the portfolio p
γ_0 theoretically equals the risk-free rate
γ_1 theoretically equals the market excess return
ε_p is the random error term

4. Results

4.1. Estimation of Stock Beta Coefficients

Table 1 represents the beta coefficients of industry and market stocks during the pandemic, grouped into three categories.

Two stocks in the market have negative beta coefficients, which suggests their price movements are opposite to the market. Meanwhile, all the beta coefficients in the industry are positive. Implying that the security's return and the market return share the same trend.

Table 1. Beta coefficients during the pandemic

Industry β	Number	Percentage
β<0	0	00.0%
0<β<1	48	67.6%
β>1	23	32.4%
Market β	Number	Percentage
β<0	2	00.1%
0<β<1	936	62.5%
β>1	23	37.4%

Table 2 represents the beta coefficients of industry and market stocks after the pandemic, grouped into the same 3 categories.

The percentage of stocks in the industry with a beta coefficient greater than one increases from 32.4% to 67.6%, indicating that the industry has become more aggressive with higher risks, but also greater potential returns. Additionally, 26 stocks in the market have beta coefficients below zero.

Table 2. Beta coefficients after the pandemic

Industry β	Number	Percentage
β<0	0	00.0%
0<β<1	23	32.4%
β>1	48	67.6%
Market β	Number	Percentage
β<0	26	1.7%
0<β<1	822	54.9%
β>1	650	43.4%

4.2. Estimation of Portfolio Beta Coefficients

Tables 3 displays the regression results for the industry during the pandemic. Market regression results are also obtained.

Beta coefficients of the portfolios are greater than or close to 1, indicating that assets have relatively high systematic risk, and investors trust their potential for continued growth. The P-value for all beta coefficients is 0.00, showing that all beta values are statistically significant at the 1% level. Therefore, it can be concluded that systematic risks reliably predict returns for both the industry and the market during this period.

Only one portfolio in the industry and five portfolios in the market have alpha values significant at the 5% level, which means there is little excess return that cannot be explained by the market, supporting the validity of the CAPM.

R^2 for all portfolios in both the industry and the market is close to 1.

In summary, during the pandemic, the beta coefficients are significant, the alpha coefficients are not, and R^2 is relatively high. This suggests that systematic risk plays a central role in the determinant of prices. There is an insignificant abnormal return, and the CAPM model applies well.

Table 3. Regression results of the industry (during the pandemic)

Portfolio	β	α	p(β)	p(α)	R^2
1	1.0614629	-0.0044574	0.00	0.536	0.9913
2	1.0115504	-0.0099867	0.00	0.358	0.9791
3	1.0011073	-0.0263997	0.00	0.009	0.9873
4	0.9835911	-0.0079793	0.00	0.345	0.9866
5	0.9693266	-0.0185824	0.00	0.197	0.9627
6	0.9450008	-0.0088456	0.00	0.282	0.9865
7	0.9363983	0.0075732	0.00	0.620	0.9515

Tables 4 presents the regression results for the industry after the pandemic. Market regression results are also obtained.

The beta coefficients for the industry range from 1.01 to 1.27, while those for the market span a broader range from 0.70 to 1.15. All beta values for the industry portfolios are above 1, indicating higher systematic risk exposure. However, the market regression results show that not all portfolio beta coefficients exceed 1, suggesting that market portfolios are less volatile than those in the industry. All P-values for the beta coefficients in both the industry and the market are significant below the 1% level. This leads to the rejection of the assumption of no market risk exposure.

Regarding the alpha coefficients, all P-values are above the 5% significance level, indicating that all alpha values are insignificant. Therefore, there are almost no abnormal returns that the market cannot explain.

The average R^2 in both the industry and the market is not high compared to those during the pandemic. R^2 varies more dramatically in the market than in the industry, implying that the beta coefficient has stronger explanatory power in the industry.

The CAPM model still applies well in the industry. In contrast, its applicability is relatively weak in the market, even though the alpha values are insignificant.

Table 4. Regression results of the industry (after the pandemic)

Portfolio	β	α	p(β)	p(α)	R^2
1	1.1850112	-0.0066543	0.00	0.712	0.8613
2	1.1961080	-0.0073130	0.00	0.659	0.8827
3	1.1343998	0.0010004	0.00	0.955	0.8529
4	1.1442463	-0.0070094	0.00	0.571	0.9257
5	1.0073440	0.0016519	0.00	0.833	0.9594
6	1.2666192	-0.0128294	0.00	0.523	0.8532
7	1.1870894	-0.0016291	0.00	0.931	0.8500

4.3. Relationship between Return and Risk

Regression results are shown below in Table 5. During the pandemic, γ_1 value (the market excess return) of the market is negative (-0.610), while that of the industry is positive (0.919). This indicates that the beta coefficients and the portfolios are negatively correlated in the market but positively correlated in the industry. The overall trend remains unchanged after the pandemic. However, the magnitude of the γ_1 value decreases in both the industry and the market, suggesting a weaker connection between systematic risk and returns.

Regarding γ_0 (the risk-free rate), during the pandemic, the values were 0.758 in the market and -0.840 in the industry. After the pandemic, both values decrease. The γ_0 value of the industry is close to zero, indicating that the overall risk-free rate level is gradually stabilizing.

R^2 remains below 0.5 during both periods in both the market and the industry. The regression model does not fit very well, indicating limited explanatory power of the CAPM model.

Regarding the P-values, during the pandemic, both γ_0 and γ_1 are significant below the 1% significance level, while both industry values are insignificant. After the pandemic, γ_0 of the market is significant below the 5% level, and γ_1 is not. Both industry values remain insignificant. Therefore, in most cases, the assumption of the CAPM model is not statistically supported.

Table 5. Regression results

		γ_0	γ_1	R^2	p(γ_0)	p(γ_1)
2020	Market	0.757827	-0.610303	0.156	0.000	0.003
	Industry	-0.839927	0.919372	0.064	0.613	0.585
2024	Market	0.304765	-0.075481	0.006	0.016	0.562
	Industry	-0.098261	0.337052	0.218	0.779	0.291

5. Conclusion

The study compared the performance of stocks in the financial industry and the overall market during and after the pandemic to evaluate the validity of the CAPM model. The results show that: during the pandemic, the beta coefficients for both the industry and the market are highly significant below the 1% level, R^2 is close t 1, and alpha coefficients are insignificant, indicating that systematic risk can explain portfolio returns during this period, and the CAPM model is effective for both the industry and the market. After the pandemic, the industry beta coefficients remain significant and are greater than 1, suggesting higher systematic risk exposure. However, the explanatory power of the beta coefficient decreases, with R^2 significantly lower than during the pandemic, implying that the CAPM model no longer fits the market well, though it remains valid within the industry. Overall, the CAPM model proves more effective during periods of market volatility.

In this study, China 1-Year Government Bond Yield was chosen to represent the risk-free rate. Although this choice is theoretically sound—since government bonds are generally viewed as default-free—the actual risk-free rate in the market might differ due to factors like liquidity constraints, inflation expectations, and monetary policy shifts. Hence, it affects our estimations of beta and alpha coefficients, impacting the reliability of the results. Additionally, the sample periods used in our analysis cover 2 years only, which might limit the statistical strength of the findings, especially when summarising longer-term market trends. Moreover, the methodology is limited to the traditional CAPM framework and does not include alternative multi-factor models for comparison. Consequently, the explanatory power of the analysis may be limited, particularly if other systematic risk factors—such as size, value, or momentum—are significant in the Chinese financial market.

In the future, it would be worth looking at a longer time span that covers more varied market conditions, so it can be seen how the model holds up in different environments. It would also be helpful to put the CAPM side by side with models that factor in more variables—like the Fama-French three-factor model—to get results that are not only more robust but also easier to apply in practice.

References

[1] Sharpe William Forsyth. Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk. Journal of Finance, 1964, 19(3): 425–42.

[2] Lintner John. The Valuation of Risk Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets. Review of Economics and Statistics, 1965, 47(1): 13–37.

[3] Mossin Jan. Equilibrium in a Capital Asset Market. Econometrica, 1966, 34(4): 768–83.

[4] Black Fischer, Jensen Michael Cole and Scholes Myron Samuel. The Capital Asset Pricing Model: Some Empirical Tests. Studies in the Theory of Capital Markets, edited by Jensen Michael Cole, Praeger, 1972: 79–121.

[5] Fama Eugene Francis and French Kenneth Ronald. The Cross-Section of Expected Stock Returns. Journal of Finance, 1992, 4(2): 427–65.

[6] Fama Eugene Francis and French Kenneth Ronald. Common Risk Factors in the Returns on Stocks and Bonds. Journal of Financial Economics, 1993, 33(1): 3–56.

[7] Jin Yunhui, Liu Lin. An empirical study of CAPM in the Chinese stock market. Financial Research, 2001, 07: 106-115.

[8] Wang Yuenan, Di Iorio Amalia. The cross section of expected stock returns in the Chinese A-share market. Global finance journal, 2007, 17: 335-349.

[9] Xu Dilong, Zhang Yu. An empirical analysis of the capital asset pricing model and the Shanghai stock market. Journal of Nanchang University (Science), 2005, 02: 142-145+150.

[10] Qin Hao and Yang Xinyi. The Impact of COVID-19 Pandemic on the Effectiveness of the CAPM Model: Evidence from the Chinese Market and Pharmaceutical Industry. Advances in Economics, Management and Political Sciences, 2024, 73:253–65.

[11] Wind Economic Database. Wind, n.d., www.wind.com.cn. Accessed 29 July 2025.

[12] China 1-Year Bond Yield. Investing.com, n.d., www.investing.com. Accessed 29 July 2025.

[13] Jensen Michael Cole. The Performance of Mutual Funds in the Period 1945–1964. Journal of Finance, 1968, 23(2): 389–416.