

Analysis Of Stock Return Rate in Metaverse Industry Based on Event Study Method-- Take 1,288 Sample Data as An Example

Minjing Ling*

Zhuhai International Business Faculty, Beijing Normal University, Zhuhai, Guangdong, 519087

*Corresponding author: lingminjing0330@163.com

Abstract. With the rapid development of underlying technologies, interactive devices and related application development platforms, the metaverse has gradually shown great development potential [1]. In order to study the influence of the emergence of metaverse concept stocks on the entire industry market and related enterprises, this paper uses the event study method and Eviews software to analyze the stock returns of relevant sample enterprises in each link of the Metaverse industry chain, and draws the following conclusions: (1) No matter which links in the metaverse industry chain, the establishment of the metaverse concept stock reflects the performance of the stock price to a certain extent.; (2) Related enterprises in the development platforms and content and applications link have a significant response to the event day; (3) In the short term, the excess rate of return of relevant enterprises fluctuates greatly and generally shows a trend of decreasing first and then rising.

Keywords: Metaverse, Metaverse industry chain, Event research method, Stock return rate.

1. The Introduction

In 2021, as the first year of the metaverse, major Internet giants entered and invested in enterprises and businesses related to the industrial chain. Along with the emergence of a series of metaverse concept stocks, the concept of the metaverse in global attention continues to enhance. So how does the rise of the metaverse concept affect the market and related industries? What kind of attitude and measures should the relevant enterprises take towards the metaverse? These problems are worthy of our study[2].

This study focuses on the empirical analysis of the stock return rate of two related enterprises in each link of the metaverse industry chain, explores the market's reaction to the emergence of metaverse concept stocks and the degree of influence of related enterprises, then finally gives corresponding suggestions and inspirations according to the conclusions obtained. The innovation of this paper lies in the adoption of the event study method. By selecting the establishment of the metaverse concept stock as the event date, it analyzes the stock return rate of sample enterprises in the metaverse industry chain, so as to see the market's reaction to the concept stock and predict the development trend of the industry in the future[3].

2. Literature Review

2.1 Analysis of financial risk and stock return rate

Financial risks are mainly affected by financial liberalization, "bubble economy" and the large-scale flow of international hot capital. The formation of financial crisis is influenced by the bubble economy, which is promoted by the speculative behavior and blind asset utilization of financial institutions. Therefore, the fundamental way to prevent a bubble economy and financial crisis is to realize the sustained and stable growth of macroeconomy. The existing research methods of stock return analysis include the dividend discount model, free cash flow discount model and capital asset pricing model. The dividend discount model considers that the sum of the present value of future dividends received by investors constitutes the theoretical value of stocks. The discounted free cash flow model is based on the dividend discount model. Since the dividend discount model is aimed at paying dividends to the company's equity owners, it is necessary to accurately predict the company's

dividends in each accounting period in the future to obtain the scientific and reasonable intrinsic value of the company's stock. The capital Asset Pricing Model (CAPM) reveals the internal relationship between investment risk and expected return in the securities market and combines risk-free return rate, risk price, and risk calculation unit. But one of its assumptions -- investors could borrow at risk-free rates -- failed to realize. In addition, the beta value in the model is difficult to estimate due to the lack of historical data for some securities.

2.2 Event method and the metaverse

The event study method is a statistical method that studies if the stock price will fluctuate or have an abnormal return rate when an event occurs in the market, so as to know whether the fluctuation of stock price is related to the event. It is based on the efficient market hypothesis that stock prices reflect all known public information. Since investors are rational, they react rationally to new information. Therefore, the abnormal return can be obtained by excluding the estimated normal return assuming that an event does not happen from the actual return of the sample stock, which can measure the degree of abnormal reaction of the stock price to the occurrence of an event or information disclosure. There are similar methods like the overlap sampling method and the combined price difference method.

Metaverse refers to integrating Internet elements based on the Internet, information technologies, virtual simulation technologies, digital technologies, etc., which is an immersive experience[4]. Some scholars focus on business models, some on technological inflection points, and some on the coming bubble. From the perspective of business model, the ecological industrial chain established by the metaverse, which involves innovative technologies as well as other links, can produce a huge and long-term push for social and economic development, which will continue to produce product innovation and business model innovation. From the perspective of industrial ecology, the industries related to the metaverse are mainly concentrated in the three fields of underlying technologies, front-end equipment, and scene content [5]. From the perspective of a technological inflection point, the competition of capital to enter the market will accelerate the construction and popularization of the metaverse. Therefore, it can promote VR, AR, artificial intelligence, blockchain and other related digital economies and the real economy to achieve deeper integration[6], and open up a new development space for real enterprises. The foundation and key lie in the independent innovation of digital technologies. In the future, it will be more promising in terms of long-term development to build a metaverse based on block link-line, with data as the first factor of production and core digital assets gradually forming a broad consensus worldwide [7]. From the perspective of the coming bubble, according to the Huatai securities research report, in the third quarter of 2021, 27 A-share game-listed companies achieved revenue of 21.179 billion yuan, with year-on-year and quarter-on-quarter growth of 7.41% and 9.31% respectively. Some product purchases have also entered the payback period. The fundamentals have picked up somewhat. This marks that the metaverse is expected to make virtual consumption the mainstream consumption type and promote the game industry valuation center upward.

To sum up, there are relatively few researches on the return of metaverse stock investment at home and abroad, especially the researches on the return of metaverse stock based on the event study method.

The event study method requires that the selection of an emergency is not expected and there is no other events interfere during the event. The establishment of metaverse concept stocks is an emergency event, and market investors will not predict it in advance. Meanwhile, the interference of other events is relatively low during this period, which meets the basic research requirements. Therefore, this paper selects the event study method to analyze the influence of the establishment of the metaverse concept stock on the metaverse related enterprises and industries from the framework of the metaverse industry chain, so as to provide a certain window for relevant investment decisions.

3. Metaverse industry and research data

3.1 Data sources and sample selection

3.1.1. Data sources

The data used in this study are from Flush. The closing prices and relevant market index data of 8 listed companies in the metaverse industry chain are collected. According to the requirement that the estimation window of event study should be no less than 120 days, a total of 1288 samples were obtained for 161 trading days from January 28, 2021, to September 27, 2021.

3.1.2. Sample selection

The event date selected for this study is September 9, 2021, the official date of the metaverse stock. In order to enhance the accuracy of excess return rate, this study selects ten trading days before and after the event day as the event window period to study short-term market reaction, which is $[-10, 10]$, a total of 21 trading days. In addition, to build a highly reliable stock return market model, 140 trading days are selected as the time interval to construct the estimation period of the market model, namely $[-150, -11]$. The listed companies of the metaverse industrial chain are selected. According to the development path of metaverse, the industrial chain is mainly divided into four links: underlying technologies, interactive devices, development platforms, applications and content. A total of 8 listed companies are selected.

3.2 Descriptive statistics of data

Table 1 shows the mean value, maximum value, minimum value, standard deviation, kurtosis and skewness of sample data. From the mean value, the opening price and closing price of 300454 in the underlying technologies link are higher, indicating that the enterprise develops relatively well in this industrial chain link. As can be seen from the standard deviation, their average standard deviation is greater than 12, indicating a great difference in the development degree of related enterprises in this link. In the link of interactive devices and development platforms, the gap between the maximum and minimum values is roughly 2 times, indicating that the share price of related enterprises in this link has a certain range of large fluctuations. As can be seen from the skewness of sample enterprises in the interactive devices link, both are negative, which indicates that the share prices of enterprises in this link tend to be left-biased. As can be seen from the mean values of sample enterprises of content and applications, the closing prices of both are generally higher than the opening price, which indicates that the market recognizes the development of enterprises in this link

Table 1. Descriptive statistics of each variable

Categories	Close price (Stock code)	Mean	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis
Underlying technologies	300454	262.439900	324.00	215.33	21.071580	0.339980	3.210250
	000938	22.265590	30.30	17.62	3.088378	0.582895	2.461410
Interactive devices	002241	37.406650	52.25	25.21	5.951498	-0.154880	2.369178
	002273	12.876020	15.57	10.30	1.487409	-0.191445	1.661632
Development platforms	300036	21.364600	31.66	15.42	4.948609	0.313288	1.433089
	300624	16.400680	24.11	12.98	2.036395	1.365219	6.031796
Content and applications	300031	48.971370	75.14	37.92	7.010044	1.053283	4.177334
	300052	8.720373	20.00	6.88	2.422814	2.976656	11.601760
Categories	Open price	Mean	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis
Underlying technologies	300454	262.661800	322.86	214.14	20.793130	0.336405	3.239912
	000938	22.238070	30.39	17.60	3.099674	0.594329	2.474425
Interactive devices	002241	12.844720	15.67	10.32	1.487341	-0.187470	1.641435
	002273	37.361490	50.00	25.18	5.931576	-0.136342	2.370302
Development platforms	300036	21.294600	30.76	15.47	4.910938	0.345556	1.461836
	300624	48.897020	74.26	37.80	6.830786	0.926562	3.779512
Content and applications	300031	16.373660	23.73	12.95	1.985232	1.296818	5.711417
	300052	8.657826	19.52	6.82	2.307268	3.037348	12.10477

4. Empirical analysis of metaverse industry

4.1 Analysis of super-normal returns and cumulative super-normal returns at the enterprise level

4.1.1. Calculate expected normal earnings

Expected normal rate of return refers to the earnings generated if the price of a listed company normally fluctuates without the event's occurrence. The calculation steps are as follows:

(1) Calculate the normal return rate of stocks. See formula (1) : $R_{it}=P_{it}/P_{it-1}$.

In Formula (1), t stands for days; P_{it} represents the closing price of listed company I on the t day; P_{it-1} is the closing price of day $t-1$.

(2) Calculate the normal market rate of return. See formula (2) : $R_{mt}=M_{Pt}/M_{Pt-1}$.

Where, M_{Pt} represents the closing index of the securities market composite index on the t day; M_{Pt-1} is the closing index of the $t-1$ day.

4.1.2. Estimated abnormal return rate and cumulative return rate

In this study, eight listed companies were divided into four types according to underlying technologies, interactive devices, development platforms, applications and content, and abnormal returns (AR) and cumulative abnormal returns (CAR) were calculated, respectively (see Table 2)[8].

As shown in Table 2, taking 300454 underlying technologies as an example, its AR is -0.40, indicating that this event harms its stock return rate. The value of CAR is positive before, during, and after the occurrence of the event day. Therefore, from the overall trend, the event day has a positive impact on its stock return.

CAR represents the cumulative abnormal return rate of the sample company. It refers to the actual income after the event minus the normal income in the entire event window. According to the development of the event research method at the present stage, we choose the market model to calculate the abnormal return rate, assuming that there is a certain linear relationship between the return rate of the securities market and the return rate of a specific listed company, as shown in Equation (3): $E(R_{i,t})=\alpha_i+\beta_iR_{mt}+\varepsilon_{it}$.

In the formula, $E(R_{i,t})$ refers to the expected return rate of the stock of listed company i on t days; R_{mt} refers to the actual return rate of the securities company on the t -day; α represents regression intercept term, β represents regression slope; ε is the residual of model regression, that is, the extraordinary return of listed company i .

According to the estimated α_i and β_i , the abnormal return rate of each stock is the actual return rate of each stock minus the expected return rate of each stock, as shown in Equation(4): $AR_{i,t}=R_{i,t}-(\alpha_i+\beta_iR_{mt})$

The cumulative abnormal return rate is also calculated, as shown in Formula (5): $CAR_i=\sum AR_{i,t}$

Where $AR_{i,t}$ refers to the abnormal return rate of the stock of listed company i on t days, and CAR_i refers to the cumulative extraordinary return rate of listed company

Table 2. AR and CAR % of statistics

Category	Stocks	AR	CAR		
		[0]	[-10,0]	[1,10]	[-10,10]
Underlying technologies	300454	-0.40	12.87	7.69	20.57
	000938	0.44	5.09	-0.22	4.87
Interactive devices	002241	9.13	-33.17	129.21	96.03
	002273	6.24	-10.17	3.86	-6.31
Development platforms	300036	11.49	-6.90	37.27	30.36
	300624	-3.29	215.19	59.03	274.22
Content and applications	300031	-1.10	203.16	68.62	271.78
	300052	-10.81	100.11	-255.01	-154.90

Note: [0] represents the date of the event; [-10,0] indicates ten days before the event date. [1,10] represents ten days after the occurrence of the event date; [-10,10] represents the time window, including the event day

4.2 Analysis of the average abnormal returns and average cumulative abnormal returns of the metaverse industry at the industrial level

Statistical analysis of abnormal returns and cumulative abnormal returns of all industrial chain links on different event days shows that in the event window period, the positive value of abnormal returns and cumulative abnormal returns of the development platforms link is the largest. It indicates that the positive impact of the event of the establishment of metaverse concept stocks on the development platforms link lasts the longest. Compared with the outsized returns on the event day and the cumulative outsized returns in the ten days prior to the event, the event of the launch of a metaverse stock may have been circulated in the industry before the report and the market reacted quickly. Content and applications were not negatively impacted prior to event Day. However, in the ten days after the event's occurrence, the cumulative abnormal returns show a negative value. Combining with the abnormal returns on the event date, it can be seen that the event has a negative impact on the relevant enterprises in this link within ten days after the occurrence of the event. As shown from Table 4, the average abnormal returns (AV-AR) value of the underlying technologies link is 0.02, indicating that the average abnormal return of enterprises in this link is 2% on the event day. Av-car was greater than 0 in 10 days before and after the event and the whole event window. The value of cumulative average returns (AV-CAR) 10 days after the event decreased by about 2.4 times that of the first ten days, indicating that the event day had a certain negative effect on enterprises in the whole link, but the overall trend was relatively positive.

Table 3. The industry AV-AR with different events and AV-CAR (%)

Event Day	AV-AR	AV-CAR		
	[0]	[-10,0]	[1,10]	[-10,10]
Underlying technologies	0.02	8.98	3.74	12.72
Interactive devices	7.69	-21.67	66.54	44.86
Development platforms	4.10	104.15	48.15	152.29
Content and applications	-5.96	151.64	-93.20	58.44

4.3 Long-term trend analysis of metaverse enterprises

First, underlying technologies: The abnormal return rate of 300454 on the event day declined rapidly, and 000938 was mainly negative after the event day, which shows that the event had a certain negative impact on both of them.

Second, interactive devices: The abnormal returns of 002241 and 002273 are generally positive after the event, which indicates that the market is more acceptable for them to become metaverse concept stocks.

Third, development platforms: the cumulative abnormal return rate of 300036 was mainly positive ten days after the event, indicating that the event had a certain positive impact on it. The cumulative abnormal return rate of 300624 decreased to a certain extent after the event, indicating that the event had aspecific negative impact on 300624.

Fourth, content and applications: The cumulative abnormal return rate of 300052 decreased significantly after the event, and the negative value lasted until the 8th day after the event, indicating that the event was a negative signal for 300052 and had a long influence cycle. (See Figure 1)

From the fluctuation of the sample companies above, it can be seen that the occurrence of the event day has a certain degree of change. To a certain extent, it shows that the market may not be optimistic about related enterprises becoming metaverse concept stocks in the short term. However, it holds a positive attitude in the long term.

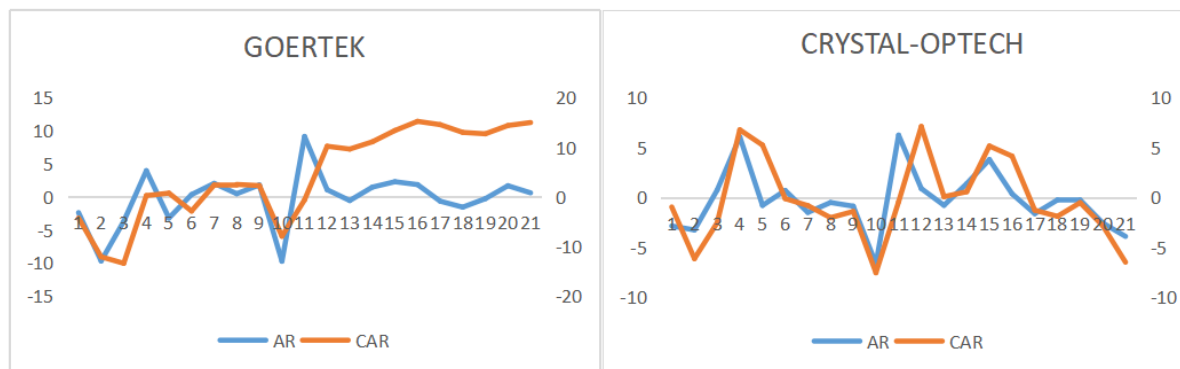


Figure. 1 Fluctuation and trend of sample data

5. Research conclusions and suggestions

5.1 Research Conclusions

This study selects the relevant data of stock trading days of 8 companies and adopts the event study method to study their reactions to the events of the establishment of metaverse concept stocks, and draws the following conclusions:

First, no matter which links the enterprise is in the metaverse industry chain, the stock price performance of the event date, namely the establishment of the metaverse concept stock, is reflected a certain extent and has a significant impact on the market value of the listed company.

Second, related enterprises have a more significant response to this event in development platforms and content and applications links.

Thirdly, the event has a great short-term impact on the relevant enterprises in each link of the metaverse industrial chain. Their abnormal returns generally show a trend of decreasing first and then increasing. In the long run, the event has a long and rising impact cycle on the content and applications-related enterprises.

5.2 Suggestions and Enlightenment

First, each link of the metaverse industry chain is still in the early stage of development. Relevant enterprises should pay more attention to the latest trends of the metaverse industry and improve the layout of relevant fields. In addition, virtual currency trading in the meta-universe also needs the support of the value system [9]. The central bank should play a leading role in developing the metaverse economy[10]. Moreover, the government must establish a systematic and normative operation mechanism and construct basic legal norms to protect data assets[11].

Second, both the government and enterprises should increase key R&D and investment related to the links of development platforms as well as content and applications. The development platforms mainly focus on applications development platforms and game engine. We mainly focus on 2B and 2C modules in the link of content and applications.

Third, in the short term, the stock prices of enterprises related to the metaverse industry chain are susceptible to the events of metaverse concept stocks, thus causing the stock prices to fluctuate greatly. Relevant enterprises should make a timely statement to avoid the existence of the metaverse hotspot speculation motivation[12]. In the long term, pertinent enterprises of the content and applications links should make long-term strategic planning and linkage development between industrial links, paying attention to appropriate technologies and enterprises in the upstream industrial chain. Furthermore, they should also carry out long-term strategic cooperation or independent research and development.

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