Research on the Influencing Factors and Development of the Metaverse Industry

Lufan Zhang[1*]

[1]School of Computer Science and Technology, Qingdao University,Qingdao, Shandong, 266071, China

*Corresponding *author*. Email: wenzi21u@126. com

Abstract. Metaverse has been closely watched by outsiders as a hot topic in recent years. In today's increasingly mature traditional Internet market, the metaverse industry is seen by many Internet practitioners as a brand new track to break the deadlock, and with the added heat, both capital and technology are rapidly pouring into the industry. Therefore, it is particularly important for Internet practitioners to accurately grasp the current state of development of the metaverse and to anticipate its growth prospects in order to gauge the potential of the industry and to develop a market-adapted development policy. In this paper, we conducted a linear regression analysis of the stock prices of companies in the metaverse industry in China and the United States, focusing on the interpretation of the influencing factors using SPSS software, and also used BP neural network to predict the future stock trend, using the stock prices as the entry point to map the development status and future trend of metaverse side-by-side. The experimental results show that the current development status and prospects of the metaverse industry are relatively clear, and it is likely to become the next development direction of the Internet market.

Keywords: Metaverse; US-China Exchange Rate; CPI, P/E Ratio; BP Neural Network

1 Introduction

As an important part of science and technology today, computer science has greatly changed and enriched human interaction, communication and social transaction methods. From the perspective of end users, the past three waves of computer innovation have revolved around personal computers, the Internet and mobile devices. Nowadays, the fourth wave of innovation is booming around space and immersive technologies such as virtual reality and augmented reality : focusing on foreign countries, the famous social platform Facebook announced on October 28,2021 that it would officially change its name to ' Meta ' and fully ' bet ' Metaverse; looking at

P. Dou and K. Zhang (eds.), *Proceedings of the 2023 International Conference on Economic Management, Financial Innovation and Public Service (EMFIPS 2023)*, Advances in Economics, Business and Management Research 287,
https://doi.org/10.2991/978-94-6463-441-9_21

China, as early as the ' Metaverse' wave began to take shape in 2020, Tencent participated in the ' Metaverse ' first ' Roblox G round of financing, and received an exclusive Chinese agent. However, there are often huge risks hidden behind the infinite potential, and the attractive benefits will also bring unpredictable negative effects : Previous studies have shown that minors often come into contact with pornographic pictures, violence, blood and other forms of harassment on VRchat through Meta 's head-mounted devices. The negative information, which lacks restraint, has a negative impact on both physical and mental health and personal development of adolescents.

Although we cannot fully assure public that the metaverse is completely harmless due to the unknown, capital injection and market expansion related to its concept still make important contributions to promoting the development of science and technology, driving economic growth and promoting employment. Under the general trend of the era, digitization and immersion enjoy popular confidence. In addition, if we take a long-term view, from the material construction of the Metaverse to the human civilization of the Metaverse, the user group also has great business opportunities for a series of spiritual pursuits such as social interaction, identity and identity. So, in summary, the participants of the track should not stop just because of the disadvantages that cannot be solved at the moment. Balancing the pros and cons in the development is the wise move.

2 Literature Review

2.1 A Study of the Current State of the Metaverse

Roblox’s listing is widely seen as a chance for the metaverse to go from a concept to a reality in the public eye. Roblox claims to be a metaverse company because it offers players a virtual world where they can transform themselves freely. But the metaverse is not just about gaming, it will also evolve into other domains [1]. For example, the virtual and real, online and offline integration characteristics of the educational metaverse will greatly expand the space-time boundary of teaching and learning, and promote the transformation of teaching concepts and models[2]. The Internet of Things medicine implemented by AR technology can solve a series of problems such as the inability to guide doctors with less experience in all time and space, control the quality of clinical medical care, and improve the level of " handicraft workshop " diagnosis and treatment among clinicians based on the integration of virtual and real in the metaverse, man-machine integration and virtual and real linkage technology, so as to promote the healthy and rapid development of medicine [3].

2.2 Metaverse and NFT

Non-fungible token (NFT) has shaken the digital asset space since 2021 when it became another brand new frontier in the financial market due to its unique property of being able to provide provable uniqueness and ownership to digitally related products. When NFTs and digital cryptocurrencies together construct an economic

value ecosystem, their unique and tamper-evident properties naturally become an important infrastructure of the metaverse for they provide a specific value conversion channel for the integration of metaverse and digital assets [4]. Meanwhile, since the underlying economic value ecosystem of the metaverse is constructed by NFT and digital cryptocurrencies, it is equally inseparable from digital cryptocurrencies to talk about the metaverse. Generally speaking, the digital cryptocurrency that the public is most exposed to is Bitcoin. Bitcoin basically functions as a currency and has some of the properties of a currency, but is not necessarily a real currency [5]. As a purely P2P virtual currency it can meet the need for decentralization, strict control over the speed of money supply, prediction of the total amount of money in circulation, and effective inflation control.

2.3 Metaverse and Stock Price Forecast

Metaverse is an emerging field, and research on stock prices in this field is relatively rare. However, as an important financial instrument that plays an indispensable role in optimizing resource allocation and long-term capital financing, stock price forecasting is an important reference in evaluating development prospects and grasping future trends. Traditionally, many studies have used only news or numerical data for stock market forecasting. But some studies have also considered a combination of both sources of information in order to fully exploit the complementary nature of both [6]. However, compared to news, digital data often plays a more important role, and thus forecasting today is still focused on analyzing data, except that with the development of technology, the means of data processing is gradually switching to the use of machine learning. As far as machine learning is concerned, deep learning methods are superior to other methods for prediction and financial modeling, as they can capture complex nonlinear patterns and dependencies in financial data . Among the different deep learning methods, CNN, as a widely used method for image processing and computer vision, can also handle financial time series data by extracting local features and reducing dimensionality; while LSTM can model sequential data with long-term dependencies, such as stock prices, exchange rates, and market sentiments ; and reinforcement learning can optimize financial decision making, such as trading strategies, portfolio allocation, and asset pricing . Other deep learning methods, such as HAN, NLP, and Wavenet, are also used for financial engineering tasks [7] [8] .

3 Research Methodology

3.1 Multiple Linear Regression Model

In the study of real-world problems, changes in the dependent variable are often influenced by several important factors, and it is then necessary to use two or more influences as independent variables to explain the changes in the dependent variable, which is known as multiple regression or multiple regression. Multiple linear regression extends simple linear regression to include multiple explanatory variables. It is generally expressed as:

$$y_i = \beta_0 + \beta_1 x_{i1} + \cdots + \beta_k x_{ik} + \epsilon_i \text{ , } i = 1,2,\cdots n,\ k \in 1,2,\cdots n \quad (1)$$

where β_0 is a constant to predict the dependent variable when all features are zero. For a model with k features, each feature has its own β coefficient. And ε is the random error (residual) of the model and $\epsilon_i \sim N(0, \sigma^2)$.

The analysis of linear regression allows us to investigate how a set of characteristics is associated with a dependent variable of interest [9] . In this paper, we tentatively argue that stock prices are linearly correlated with their many influences and thus use a multiple linear regression model to model the regression on the data.

3.2 BP Neural Network

BP neural networks are neural networks whose learning algorithms are based on Gradient descent. They are capable of minimizing the error of high-complexity nonlinear functions if an appropriate number of hidden units is provided. Theoretically, a BP with a simple hidden unit layer is sufficient to map any function y = f (x) [10] . Its computational process consists of a Forward Propagation and Forward Propagation.

Compared to data analysis software such as SPSS that mechanically combines existing data to generate equations, BP neural networks are often able to obtain more accurate and more informative forecasts due to their unique forward propagation and backward feedback mechanisms. Combined with multiple linear regression, BP neural networks are used to predict the future stock price trend by fitting the most suitable prediction model and the already available feature values, reflecting the future potential value of the metaverse side-by-side, and thus providing a clearer grasp of the future economic effect and potential value of the metaverse.

4 Analysis of the Current Situation of the Metaverse Industry

4.1 Network Conditions of the Metaverse

When it comes to the technical aspects of the metaverse, the network is an essential part. As the communication foundation of the metaverse, the degree of development of network will directly determine the development speed of the metaverse. From 1G to 4G, hardware carriers are constantly updated from media to personal PC to smart terminals, while the emergence of 5G brings interactive devices into the public's daily life, making immersion and aggregation become the new "keywords" for user interaction. At present, China's 5G development is in the key window of high-speed development, according to relevant data, as of the end of May 2022, China's cumulative 5G base stations built and opened has reached 1. 7 million, accounting for 16. 7% of the total number of mobile base stations, the cost of 5G communications further reduced, while at the same time, 5G cell phone users have reached 428 million households, the user base is rapidly expanding, occupying cell phone 25. 8% of

mobile phone users. The gradual reduction of costs and the rapid expansion of the user base have paved a favorable development background for the growth of the metaverse. A faster, cheaper and more stable network is gradually penetrating the daily life of the general public, creating a fertile soil and a solid foundation for the growth of metaverse.

4.2 Hardware Equipment of the Metaverse

Of course, the realization of the metaverse in addition to network conditions is inseparable from the support of hardware devices. As mentioned in the previous article, with the continuous development of network technology, Web2. 0 relying on the dividend of the traffic model gradually dried up, the top talent of the major platforms began to seek transformation, the Internet is in the eve of a major change, Web3. 0 has been quietly penetrate the traditional Internet. Among the 5 key technologies needed to support VR/AR, 5G, cloud computing, AI and blockchain in the metaverse, the VR/AR industry, as the "entrance" to the metaverse and an important part of Web 3. 0, is ushering in a new phase of underlying logic change and substantial industry recovery. According to IDC data, although XR headset device shipments fell in 2022 compared to 2021, growth is expected to resume in 2023, and shipments will grow 31. 5% year-on-year, and are expected to continue to grow by more than 30% in the next few years, with shipments reaching 31. 09 million units in 2026.

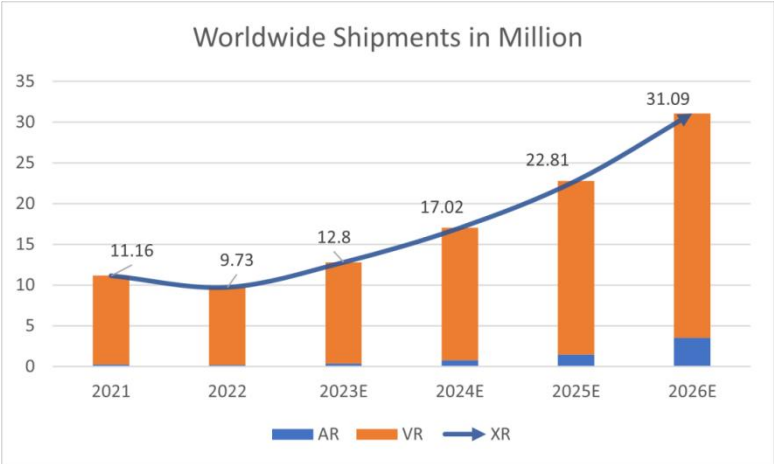

Fig. 1. Global VR/AR shipments（million）

At present, although there are some errors in the cohabitation data of the data platform, the overall trend shows that VR technology has been relatively mature and entered the period of soft power improvement, while AR is still in the period of technical improvement, and there is still much room for development. In general, from a long-term perspective, the development of the future metaverse is still considerable.

4.3 Blockchain and Related Technologies

At present, the construction of the metaverse is also inseparable from the support of blockchain technology. In a broad sense, blockchain technology is a new distributed infrastructure and computing paradigm. Because of its remarkable characteristics such as decentralization and strong encryption, it was once considered by the mainstream as one of the basic elements of the development of the metaverse. Take finance as an example, in the current social and financial system, the issuance and circulation of money is controlled by specific third-party institutions, meaning that relevant decisions are often biased, limited and cannot be absolutely objective and fair; at the same time, due to the different policies of different countries, global transactions often have a series of defects such as high fees and low efficiency. The decentralization of blockchain technology makes any node possible to become a phased center, so that each center can restrict and supervise each other, eliminate differences, avoid the limitations of central decision-making, and further realize the interconnection of all things. At present, as the value embodiment of the virtual world, Bitcoin and non-fungible token based on blockchain technology are in the stage of exploration and development. It is expected that with the rapid expansion of the metaverse market, it is expected to establish a new monetary and financial system in the future.

5 Data Collection and Analysis

5.1 Multiple Linear Regression Model Analysis

This paper is based on a multivariate linear model, with the independent variables selected being the U. S. -China exchange rate, the domestic consumer price index, and the P/E ratios of Tencent and Meta, and the dependent variables being the stock prices of Tencent and Meta. the time frame of Meta's P/E ratio is from January 2020 to June 2022, and the time frame of the rest of the data is from January 1, 2019 to June 31, 2022. Among them, the Chinese and U. S. exchange rates, Tencent and Meta stock prices are sourced from the relevant financial website Yingwei Caijing (https://cn. investing. com/), Tencent and Meta P/E ratios are taken from Baidu Stock Market Access (https://gushitong. baidu. com/), China consumer price index is taken from The China Consumer Price Index is obtained from the official website of the Central People's Government of the People's Republic of China (http://www. gov. cn/index. htm), and the U. S. Consumer Price Index is obtained from FRED (https://fred. stlouisfed. org).

Table 1. Tencent analysis results

Coefficient[a]				
	Unstandardized coefficient	Standardized coefficient		

Feature	B	Standard deviation	Beta	t	Significance
(Constant)	1623. 147	387. 315	-	4. 191	0. 000
CPI	-19. 254	11. 320	-0. 262	-1. 701	0. 097
PE	4. 729	0. 892	0. 577	5. 300	0. 000
Exchange Rates	-193. 946	62. 867	-0. 493	-3. 085	0. 004

a. Dependent variable: Tencent stock price

Table 2. Meta analysis results

Coefficient[a]					
	Unstandardized coefficient		Standardized coefficient		
Feature	B	Standard deviation	Beta	t	Significance
(Constant)	1044. 973	389. 508	-	2. 683	0. 013
CPI	0. 586	0. 848	0. 113	0. 691	0. 496
PE	4. 961	0. 899	0. 737	5. 517	0. 000
Exchange Rates	-162. 673	26. 751	-0. 705	-6. 081	0. 000

a. Dependent variable: Mata stock price

According to Table 1,we can see that, with reference to the standardized coefficient Beta, Tencent's stock price is negatively correlated with CPI and the US-China exchange rate, and positively correlated with its price-to-earnings ratio (PE). First, the share price is negatively correlated with CPI, which indicates that Tencent's share price will keep falling as CPI rises. Usually, rising CPI indicates rising prices, and thus rising stock prices, but the opposite result is shown here. It can be speculated that, at present, although prices are rising, Tencent's own business situation is not ideal and the capital market is not optimistic about its future development, resulting in a decrease in its earnings; secondly, Tencent's stock price is negatively correlated with the exchange rate between China and the US, which indicates that Tencent's stock price will also fall as the exchange rate between China and the US rises. The preliminary reason for this is that the rise in exchange rate makes it difficult to export domestic goods, and the lack of overseas competitiveness is greatly affecting Tencent's overseas business ,causing the decrease of its earnings;

Finally, the P/E ratio is proportional to the stock price because it is defined as the ratio of stock price divided by earnings per share, which is obviously positively correlated in the absence of other factors.

An analysis of Table 2 shows that Meta stock price is positively correlated with CPI and its P/E ratio, and negatively correlated with the US-China exchange rate. The positive correlation between the stock price and CPI indicates that Meta's stock price increases with the rise in prices. This shows that Meta's own operation has not been affected by the complex factors such as price increase, and is still in good condition. The transformation to Meta Universe has not weakened its competitiveness in the market, but has produced positive results. And the negative correlation with the exchange rate between China and the U. S. indicates that Meta's export business to China is not satisfactory. The rise of the exchange rate between the U. S. and China reduces the difficulty of exporting to the Chinese market for U. S. companies, yet Meta did not make corresponding countermeasures to actively respond to the situation, resulting in its stock price not rising gradually as anticipated. Comparing Table 1 and Table 2, it can be found that although the stock prices of Tencent and Meta are positively correlated with their price-earnings ratios, they still have differences in values. The modeling results show that the standardization coefficient of Meta is larger than that of Tencent. According to the definition of PE ratio, the stock price is equal to the PE ratio multiplied by earnings per share. And referring to the linear regression model, the earnings per share is the slope of the straight line, which is the standardized coefficient of the model. Therefore, it can be known that according to the current data, the current earnings per share (EPS) of Meta is higher than that of Tencent. Since EPS can reflect operating conditions of the reformed company and the bullishness of the market to a certain extent, it can be inferred that Meta, which has transformed the metaverse, has more advantages in the capital market. Tencent, on the other hand, which has chosen to maintain its business strategy in recent years, appears to be underpowered and slightly sluggish. Therefore, it can be predicted that the future development potential of Meta Universe is highly promising.

5.2 The Analysis of Bp Neural Network

Compared to SPSS which builds models based on fixed patterns, neural networks are more often used for their ability to make more accurate predictions due to their self-learning mechanism on coefficients.

Compared to SPSS which builds models based on fixed patterns, neural networks are more often used for their ability to make more accurate predictions due to their self-learning mechanism on coefficients.

The S&P 500 index, CSI 500 ETF, and US-China exchange rate are selected as the hypothetical function features, and the stock prices of the two companies are selected as the labels of the functions, respectively. For the data related to Meta and Tencent, the model uses a random method to divide the test set and training set. Five groups are randomly selected as the test set, and the remaining samples are used as the training set of the model to train the neural network.

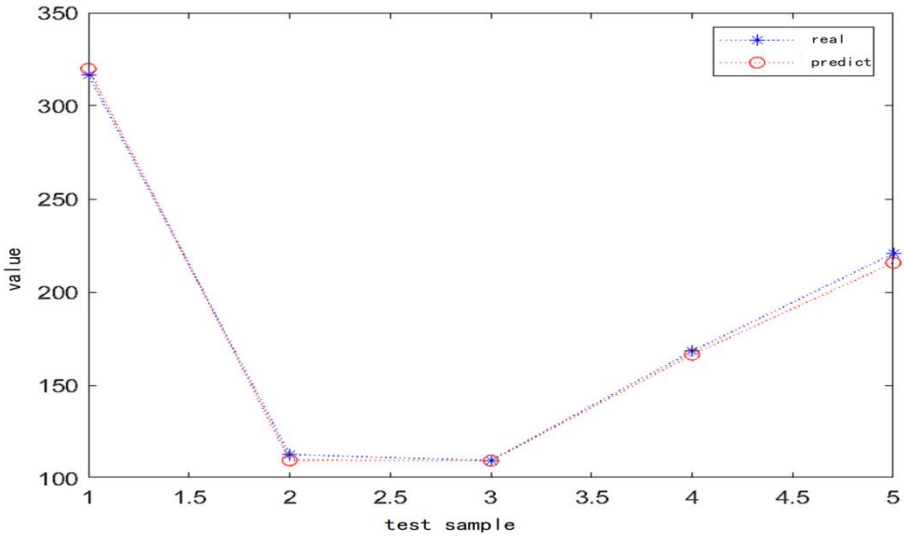

Fig. 2. Meta BP prediction effect

Table 3. Comparison of Meta Predicted Data

Group No.	True Value (USD)	Predicted Value (USD)	Percentage Error (%)
1	316. 50	319. 84	-1. 04
2	112. 84	109. 78	2. 79
3	109. 58	109. 51	0. 06
4	168. 30	166. 41	1. 14
5	220. 75	215. 79	2. 30

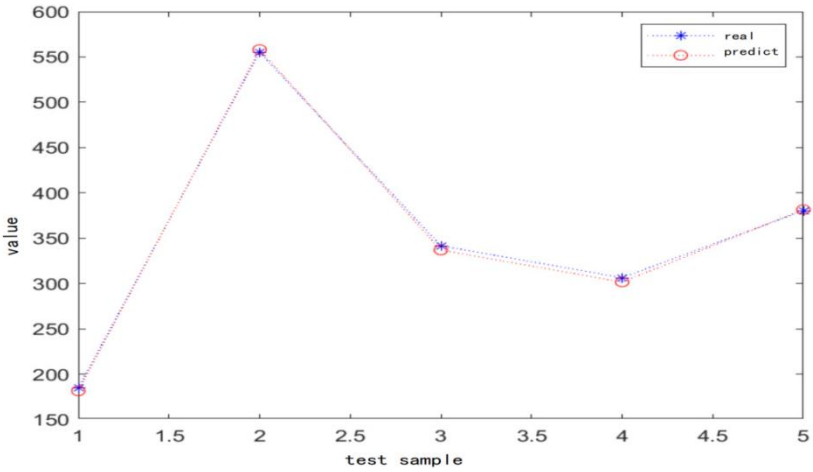

Fig. 3. Tencent BP prediction effect

Table 4. Comparison of Tencent Predicted Data

Group No.	True Value (HK$)	Predicted Value (HK$)	Percentage Error (%)
1	184. 87	181. 45	1. 88
2	555. 18	558. 18	-0. 54
3	341. 65	336. 97	1. 39
4	306. 4	301. 61	1. 59
5	380. 28	381. 54	-0. 33

Based on the images as well as the tabular data, the model has been shown to have a highly desirable prediction accuracy after several experiments.

6 Conclusion

According to the results, the metaverse can indeed bring considerable benefits, given the involvement of both companies in the meta-universe and their business strategies. As the leading Internet company in China, Tencent's financial situation has been declining in recent years under its conservative business strategy, while Meta, which has chosen to subvert itself into the metaverse, has been thriving in recent years. Clearly, according to the comparison, the key to gaining vitality in today's increasingly competitive market is to cleverly use emerging concepts to find another way.

The reasons for this, combined with the research data, can be seen: First, as a new concept, the high level of topic heat of the metaverse is obvious. In an era when traffic is king, whether in China or the United States, high buzz can bring huge economic effects, not only in terms of investment in technology, but also in a series of

issues related to the concept and ethics, which can attract capital injection. Secondly, in addition to the hot topic, as a concept abstracted from reality, metaverse also has a superior production potential than reality. As a virtualized product of the real world, metaverse can break the time and space limitations that reality has, and truly achieve globalization and liberalization. So it is strongly supported by the national policy and has a bright prospect. Finally, at the current stage, the metaverse has already got the initial technical support. Even with capital and policy support, a concept without technology support is like a bubble, wonderful but fleeting. According to the relevant reports, the current technology has already been able to initially support the construction of the metaverse environment. Network, hardware, software and a series of fundamental environments built for the metaverse are already in use and are growing rapidly with the support of capital and policies.

In summary, from the multiple perspectives of evaluating the potential of a concept, metverse undoubtedly has broad development prospects and opportunities. Just like the market revolution brought by the popularity of e-commerce in the past, meta-universe is a good development trend for the traditional Internet market that is approaching saturation.

References

1. Yang Ke. "The metaverse" erupts, and what the "metaverse" beyond the game can bring [J]. Fortune Age, 2021 (10): 20
2. Zhong Zheng, Wang Jun, Wu Di, Zhu Sha, Jin Shuaizhen. Analysis of the application potential and typical scenarios of the educational metaverse[J]. Open Education Research, 2022,28 (01): 17-23. DOI: 10. 13966/j. cnki. kfjyyj. 2022. 01. 002
3. Qi Lulu, Jin Xiaolu. The new medical model of metacosmic medicine [N] Health News, 2022-03-02 (006). DOI: 10. 28415/n. cnki. njika. 2022. 000794
4. Wei Liting, Guo Yan, He Mengjiao. Nonhomogeneous Tokens (NFT): Logic, Application and Trend Outlook [J]. Economic Research Reference, 2022 (04): 130-140. DOI: 10. 16110/j. cnki. issn2095-3151. 2022. 04. 009
5. Jia Liping. Theory, Practice and Influence of Bitcoin [J]. International Finance Research, 2013 (12): 14-25
6. Liu G, Wang X. A numerical-based attention method for stock market prediction with dual information [J] . Ieee Access, 2018, 7: 7357-7367.
7. Nikou M, Mansourfar G, Bagherzadeh J. Stock price prediction using DEEP learning algorithm and its comparison with machine learning algorithms [J] . Intelligent Systems in Accounting, Finance and Management, 2019, 26(4): 164-174.
8. Hu Z, Zhao Y, Khushi M. A survey of forex and stock price prediction using deep learning [J] . Applied System Innovation, 2021, 4(1): 9.
9. Tranmer M, Elliot M. Multiple linear regression[J]. The Cathie Marsh Centre for Census and Survey Research (CCSR), 2008, 5(5): 1-5.
10. Buscema M. Back propagation neural networks[J]. Substance use & misuse, 1998, 33(2): 233-270.