

Analysis of Investment Value of Chinese Tide Play Firms- Based on Hierarchical Analysis and Factor Analysis

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Abstract. In recent years, China's tide play enterprises are developing rapidly, the market potential is enormous, and a large amount of capital is flowing into the industry. Therefore, the specific analysis of the investment value of the tide play industry has important research significance. This paper first analyzes the macro environment and industry situation the tide play industry faces. Finally, to deal with the complex information of financial indicators, this paper establishes a stock scoring model that combines hierarchical and factor analysis with fundamental quantitative analysis. The factor analysis method is used to reduce the dimensionality of financial indicators. The hierarchical analysis method is applied to assign weights to each factor, and finally, the total score is derived. Taking the four listed companies that focus on upstream IP creation and operation among the tide play representative companies as an example, four stocks were selected and analyzed for financial indicators. It was concluded that Bubble Mart stock scored higher than Yuanlong Yatou higher than Gaolak stock higher than Aofei Entertainment. On the one hand, this study helps investors to look at the investment value of the tide play industry more rationally and helps the tide play industry to develop benignly; on the other hand, the establishment of this paper's model is helpful to scientifically deal with the complicated financial index information and enhance the universality of financet.

Keywords: Tide Play Companies, Hierarchical Analysis, Factor Analysis, Quantitative Analysis of Fundamentals.

1. Introduction

Tide play, that is, trendy toys, also known as art toys or designer toys. It is a toy that integrates art, animation, design, and other multi-element concepts, with independent IP and trendy attributes. Most are ornaments, sculptures, etc., lacking practicality and interactivity but with light luxury attributes. Tide play initially appeared in Hong Kong and Japan due to limited production and high pricing, so more niche. China's modern game industry has undergone huge changes in the last decade.

According to Bubblemart's prospectus, the growth rate of Chinese hip-hop play enterprises is rapid. According to Figure 1, from 2015-2020, the market size of hipster plays enterprises rose, and the growth rate was maintained at around 10%. According to data from Emmi Consulting, the market size of hipster play enterprises is expected to reach 57.1 billion yuan in 2023, 6.34 times that of Japan, the birthplace of hipster play. In recent years, consumers have become more open and enthusiastic about trendy culture against the backdrop of encouraging diversity and the rise of Generation Z consumers. At the same time, the development of the pan-entertainment market and social media has further promoted the popularity of trendy culture. As an essential carrier of trendy culture, the trendy toy market still has a large potential to be explored. According to the Foresight Industry Research Institute, the industry may maintain a growth rate of more than 20%, and the market size will exceed 100 billion in 2026.

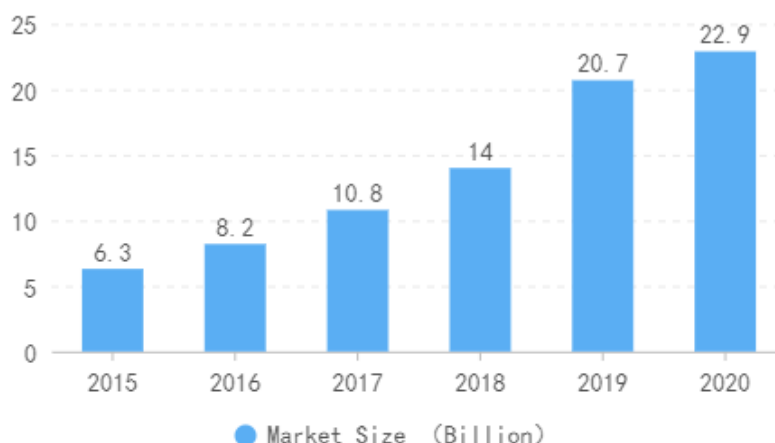


Figure 1. 2015-2020 tide play industry growth rate

With the rapid development of China's tide play enterprises, listed companies are distributed in various parts of the industry chain. The industry within the enterprise investment value-related analysis needs to be studied.

Meanwhile, as the information involved in fundamental analysis becomes more and more complex, fundamental quantitative investment analysis is gradually becoming a hot research topic in investment science. Fundamental analysis takes a more qualitative approach by comprehensively mining enterprise information, while quantitative investment fully uses mathematical models and computer technology to process a large amount of data information. In this paper, we will draw on the idea of fundamental quantitative investment to establish a mathematical model for stock scoring through fundamental information and select four tide-to-play enterprise upstream industry chain representative enterprise stocks, namely Bubble Mart (09992. HK), Aofei Entertainment (002292. SZ), Gaole (002438. SZ), Yuanlong Yato (002878. SZ) for empirical analysis.

2. Macro Analysis

2.1. Gradual economic recovery

During the Spring Festival 2023, sales revenue of the mainland's national consumer industry increased by more than 10% compared to last year. The vitality of consumer goods retail and food service industries was further enhanced. This year's Spring Festival travel scale, consumption structure, and other data laid the foundation for the economy to "start high and grow steadily and continue to rebound," and the economy is expected to rebound.

Studies show that for every 1% increase in the money supply (M2), the residential consumption level increases by 0.78%. And since 2022, the reserve requirement ratio of financial institutions has been cut twice, and the market quoted interest rate (LPR) of loans has been cut three times. The recent Central Work Conference has also released signals such as "focus on supporting the expansion of domestic demand" and "the total amount should be enough." It is expected that in 2023, China may continue to cut rates and interest rates to implement a precise and prudent monetary policy to help the development of enterprises. From the demand-side perspective, the tide play enterprises face a more optimistic macroeconomic environment.

2.2. Tax policy incentives to help the development of tide play enterprises

Dongguan, Guangdong Province, is known as China's "tide play capital" according to the "China Trendy Toy Market Development Report 2021", one-third of China's tide play by Dongguan enterprises production. Many cities, represented by Dongguan, have formulated tax relief policies to help the development of trendy toy enterprises utilizing "real money" so that they have more funds to invest in IP design and technical improvement.

In addition, the government arranges tax specialists for tide play enterprises. The financial personnel of enterprises can solve tax problems through V-TAX remote visual tax system, making production smoother. The tax department also provides customized services for the tide play enterprises. It sets up a "tide play enterprise tax service team" to analyze the development of enterprises with big data and carry out targeted visits so that enterprises can enjoy policy dividends and solve tax problems more efficiently.

2.3. Industry standards continue to regulate

On January 25, 2022, the Shanghai Municipal Bureau of Market Supervision issued the first blind box business activities guidelines --- "Shanghai Blind Box Business Activities Compliance Guidelines" (from now on referred to as "Guidelines"). The Guidelines delineate the red line for producing "blind boxes". They will introduce relevant laws and regulations on this basis as soon as possible so that tide play enterprises can operate well on the legal track. The "Guidelines" to the tide play enterprises to curb excessive marketing, product red line, clear probability information, and other requirements to establish the basis for legal norms.

On August 16, 2022, the State Administration of Market Regulation issued a notice on the public consultation of the "Blind Box Business Activities Specification Guidelines (for trial implementation) (draft for comment)," comments, public rules clear code price tag, and other requirements, at the regulatory level to give clear guidance for tide play enterprises to regulate their operations to provide a clearer direction, which is conducive to creating a cleaner market environment. The continuous introduction of relevant national regulations will effectively promote the benign development of tide play enterprises and the growth of the tide play market.

3. Industry Analysis

3.1. Tide play market scale is expanding, and the market outlook is good

In recent years, China's tide play market has been booming. 2015 China's tide-play enterprise market size scale reached 6.3 billion yuan, with a 2015-2020 compound annual growth rate of up to 36%; in 2022, China's entire trendy toy retail market size will reach 47.8 billion yuan. According to Forst & Sullivan, China's tide play market size is expected to grow to 21.9 billion yuan in 2023. And according to the data of enterprise search cat, the investment and financing enthusiasm of the trendy play industry is extremely high, and the capital is very optimistic about the prospect of the industry. There are nearly ten major investment and financing events in the trendy play industry in the second half of 2020; with more than 10 million yuan, a large amount of capital flows into the industry. Along with the gradual stabilization of the epidemic and economic recovery, China's tide play market outlook is very optimistic.

3.2. Industry chain is becoming more and more perfect

In recent years, the industrial chain of Chinese hip-hop enterprises has also been maturing and improving. The business process of hip-play enterprises is mainly divided into three stages: IP creation, hip-play manufacturing, and hip-play sales. Bubble Mart is the only hip-play enterprise that lays out the whole industry chain. However, there are many enterprises and studios that focus on a single industry chain link in the upper, middle, and lower reaches, and the industry chain operation has been more mature.

3.3. Brief analysis of the competitive landscape

As of 2020, China has registered 250 tide play enterprises, mainly concentrated in the eastern region, of which Guangdong Province is the most intensive. In terms of sales market share, the market concentration is relatively fragmented. Although Bubble Mart has the highest market share, there are

still a large number of gaps in the industry waiting for enterprises to dig and occupy. Tide play enterprises still have more tremendous growth potential and development opportunities.

4. Analysis of financial indicators based on hierarchical analysis and factor analysis

4.1. Introduction to the basic principles of FA and AHP

Factor analysis is a multivariate statistical analysis method that reduces some variables with overlapping information and intricate relationships into a few unrelated and comprehensive factors by studying the dependency relationships within the correlation matrix of indicators. Due to the large number of financial indicators and their complex relationships, this paper decides to apply factor analysis to reduce the dimensionality of indicators.

Suppose that the p -dimensional random vector $x = (x_1, x_2, \dots, x_p)$'s mean value $\mu = (\mu_1, \mu_2, \dots, \mu_p)'$.

The general model for factor analysis is:

$$\begin{cases} x_1 = \mu_1 + a_{11}f_1 + a_{12}f_2 + \dots + a_{1m}f_m + \varepsilon_1 \\ x_2 = \mu_2 + a_{21}f_1 + a_{22}f_2 + \dots + a_{2m}f_m + \varepsilon_2 \\ x_p = \mu_p + a_{p1}f_1 + a_{p2}f_2 + \dots + a_{pm}f_m + \varepsilon_p \end{cases} \quad (1)$$

$f_1, f_2, \dots, f_m$ are common factors, i.e., the original variables $x_i (i = 1, 2, \dots, p)$ certain characteristics that are shared. $\varepsilon_i (i = 1, 2, \dots, p)$ is the random error. The above model is represented in a matrix that can be written as:

$$x = \mu + Af + \varepsilon \quad (2)$$

Therefore, it is only necessary to solve this matrix, A , to know the relationship between the factors and the original variables and thus simplify.

The hierarchical analysis method, i.e., by establishing a progressive hierarchy, translates human judgment into comparing the importance of several factors between two, thus transforming a qualitative judgment that is difficult to quantify into an actionable comparison of importance above.

First, it is necessary to obtain the judgment matrix by reviewing the literature and issuing questionnaires, etc. Let $\lambda_{\max}$ be the maximum characteristic root of the judgment matrix, and ω be its corresponding eigenvector, and solve for the eigenvalues of the vector. $\lambda_{\max}$ and ω are calculated as follows: multiply the elements in the judgment matrix by rows, open the resulting product n (order) times, and normalize the square root vector to obtain:

$$\omega = (\omega_1, \omega_2, \dots, \omega_k)' \quad (3)$$

$$\omega_i = \frac{\omega_i'}{\sum_{i=1}^k \omega_i'} \quad (4)$$

$$\lambda_{\max} = \sum_{i=1}^n \frac{(AW)_i}{nW_i} \quad (5)$$

The judgment matrix is also subjected to a consistency test to reduce the error. The CI is the consistency index. $CI = \frac{\lambda_{\max} - n}{n - 1}$. RI is the average consistency index, which is a constant value.

CR=CI/RI, when $CR \leq 0.1$, it passes the consistency test.

In summary, this paper uses factor analysis to reduce the dimensionality of each financial index and then uses hierarchical analysis to weigh each factor in calculating the relevant score.

4.2. Index processing

In this paper, we mainly focus on listed companies that concentrate on upstream IP creation and operation among tide play representatives and select four stocks, namely Bubble Mart (09992. HK), AoFei Entertainment (002292. SZ), Gaole (002438. SZ) YuanLongYatu (002878. SZ) to construct a factor analysis and stratification analysis model for scoring.

First, the financial indicators are selected. In this paper, ten indicators of earnings per share, net assets per share, return on net assets, the growth rate of the main business, profit growth rate, the growth rate of total assets, the growth rate of capital surplus, total equity, capital equity ratio, and revenue from main business ratio are selected for stock scoring. The specific data are shown in Table 1.

Table 1. Financial index

	Bubble Mart	AoFei Entertainment	Gaole	YuanLongYatu
Earnings per share	0.6200	-0.3300	-0.1100	0.5300
Earnings per share	4.8600	3.0700	0.6900	4.2100
Return on net assets	0.1117	-0.0652	-0.1103	0.0868
Growth rate of the main business	0.7866	0.1166	-0.1339	0.1484
Profit growth rate	0.6330	0.0930	0.5426	-0.2547
Growth rate of total assets	0.1940	0.0700	-0.2000	0.1734
Growth rate of total equity	0.0000	0.0896	0.0000	-0.0005
Growth rate of capital surplus,	0.0320	0.1930	0.0000	0.0470
Total equity(Ten Thousand Yuan)	92.30	147870.00	94720.00	22141.40
Capital equity ratio	0.8200	0.7000	0.7000	0.5800
Revenue from main business ratio	1.0000	0.0979	0.5888	0.5090

Source: Bubble Mart 2021 Annual Corporate Report; AoFei Entertainment 2021 Annual Corporate Report; Gaole 2021 Annual Corporate Report; Yuanlong Yato 2021 Annual Corporate Report

In this paper, we will use SPSS software for data analysis, automatically standardizing the above indicators, so we will not do dimensionless processing here.

The analysis yields the gravel plot as follows, which shows that the first three factors correspond to steeper changes in eigenvalues. From the fourth factor onward, the changes in eigenvalues are flatter, so three factors should be selected for analysis.

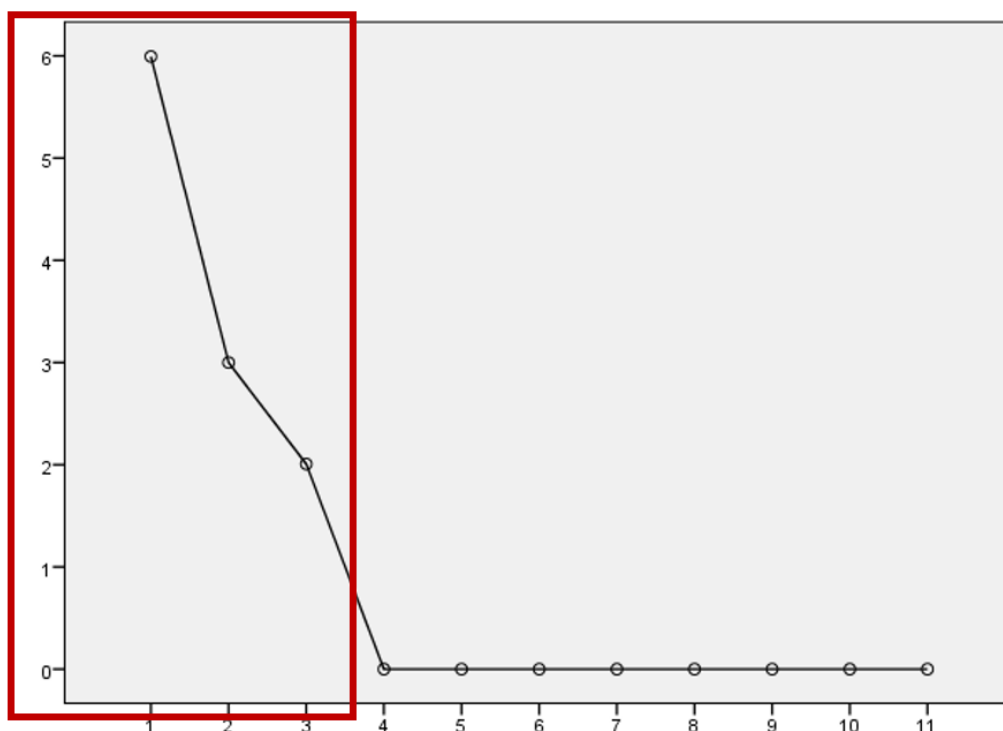


Figure 1. Scree plot (The ordinate is the eigenvalue and the abscissa is the number of factors)

The table of variance of the common factors is obtained as Table 2, and it can be seen that the three extracted common factors contribute 100% to the variance of each indicator, which can effectively explain the information of the variables.

Table 2. Common factor variance (left) and rotated component matrix (right)

	initial	extract	composition		
Earnings per share	1	1	1	2	3
Earnings per share	1	1	0.735	-0.678	-0.008
Return on net assets	1	1	1	0.011	0
Growth rate of the main business	1	1	0.927	-0.375	-0.031
Profit growth rate	1	1	0.821	-0.13	0.555
Growth rate of total assets	1	1	-0.256	-0.256	0.932
Growth rate of total equity	1	1	0.99	0.098	-0.1
Growth rate of capital surplus,	1	1	-0.063	0.998	-0.016
Total equity(Ten Thousand Yuan)	1	1	0.145	0.982	-0.123
Capital equity ratio	1	1	-0.642	0.764	-0.063
Revenue from main business ratio	1	1	0.144	0.03	0.989
Extraction method: principal component analysis			0.337	-0.783	0.522
			Extraction method: principal component analysis		
			Rotation method: Caesar's normal maximum variance method		

The resulting rotated component matrix is shown in Table 2, and the known component matrix is the factor loading matrix. Factor loadings are the correlation coefficients of variables and PR factors. When the absolute value of the loading of a variable in a public factor is larger, it indicates that the variable is more closely related to the public factor, i.e., the public factor is more representative of the variable. After analysis, factor 1 is more closely related to earnings per share, net assets per share, and return on net assets; factor 2 is more closely related to the growth rate of revenue from the main business, profit growth rate, total assets growth rate, total equity growth rate, and capital surplus

growth rate; factor 3 is more closely related to total equity, capital equity ratio and revenue from main business ratio. Therefore, factor 1 can be called the "profitability factor (Y1)", factor 2 is the "growth factor (Y2)," and factor 3 is the "risk factor (Y3)".

The following equation can be obtained from the matrix of component score coefficients.

$$Y_1 = 0.118x_1 + 0.242x_2 + 0.191x_3 + 0.181x_4 - 0.094x_5 + 0.249x_6 + 0.073x_7 + 0.123x_8 - 0.087x_9 \\ + 0.027x_{10} + 0.006x_{11}$$

$$Y_2 = -0.149x_1 + 0.092x_2 - 0.039x_3 + 0.085x_4 - 0.014x_5 + 0.109x_6 + 0.307x_7 + 0.310x_8 - 0.177x_9 \\ + 0.117x_{10} - 0.167x_{11}$$

$$Y_3 = -0.076x_1 - 0.010x_2 - 0.059x_3 + 0.225x_4 + 0.391x_5 - 0.046x_6 + 0.089x_7 + 0.038x_8 + 0.052x_9 \\ + 0.439x_{10} + 0.152x_{11}$$

4.3. Factor weighting

Next, we need to use hierarchical analysis to assign weights to the above three factors and calculate the final score for each stock. Before that, this paper needs to specify the target, criterion, and solution levels.

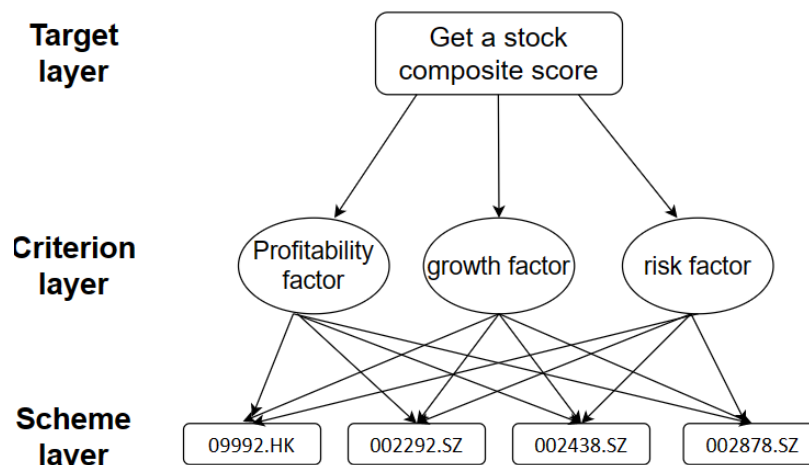


Figure 2. Structure diagram of analytic hierarchy process

In this paper, a questionnaire was issued to people with more than two years of stock speculation experience (see Appendix 1 for the content of the questionnaire), and 26 judgment matrices were obtained, of which 18 passed the consistency test. According to the above 18 judgment matrices, the final weight of each index is 0.4469 for profitability, 0.2600 for growth, and 0.2930 for risk.

Based on the metrics of the four stocks for 2021, their total scores can be calculated in the table below, which shows that the final combined ranking of the four stocks is Bubble Mart, Yuanlong Yatou, Clorox, and Aofei Entertainment. Regarding profitability and growth scores, Bubble Mart is currently more profitable and has higher growth potential for the remaining three stocks.

Bubble Mart is the only hipster game company in the industry with a full industry chain, listed in Hong Kong in 2020, and has since risen rapidly in market capitalization and is known as the "Maotai of the cultural and creative industry. In terms of profitability and growth, the company's gross profit rose from \$1594 million in 2020 to \$2759 million in 2021, an increase of 73.1%. Regarding sales of tide play blind boxes on the Amoy platform, Bubble Mart has the highest market share of 29%, with a difference of as much as 25% from the second place, which shows its profitability and growth. However, in terms of risk, Bubble Mart scored much lower than the remaining three companies. 2020 Bubble Mart topped the "blind box first stock" in Hong Kong after the listing, the opening was doubled, and maintained an upward trend for more than two months. The P/E ratio in the same industry sector was only 27, but Bubble Mart's P/E ratio reached 200 on the day of the IPO, but by the close of March 26, 2021, Bubble Mart's share price had fallen 60% from its peak, presenting a

grand bubble trend. In addition, Bubble Mart has been caught in negative reports of being fined occasionally since its IPO, as the industry standard for blind boxes is in a constant state of soundness.

And Yuanlong Yatou is in a more robust operating position, with a much higher riskiness score than Bubble Mart. Especially in the first three quarters of 2021, as the provision of Winter Olympics licensed merchandise, such as ice dunnage handicrafts, plush toys, etc., according to its annual report, Yuanlong Yatou licensed souvenir revenue has increased 141.57% year-on-year. However, there is a situation of increased revenue without profit.

Founded in 1989, Gaole has a stable overseas customer base through years of overseas market expansion, with a sales network spanning major developed and developing countries worldwide. However, Gaole encountered difficulties in its operation and was taken over by Huatong Group in 2022. The toy business faces the dilemma of increasing costs and lower gross margins, poor profitability, and declining growth potential. However, the risky score is higher due to its brand influence accumulated over the years in the toy industry and years of solid business conditions.

AoFei Entertainment, listed in 2010, is one of China's stronger and more promising animation and entertainment culture industry groups and has experienced significant changes in profit since 2015, showing a downward trend. Currently, AoFei Entertainment has a single homogenized development model, a shrinking market share, and an unpromising profit and cash flow position. Due to the aggressive M&A restructuring and massive cash out by top management since FY14, AoFei Entertainment's profitability, and growth is poor. However, if it observes the market situation, reviews its situation, appropriately slows down its M&A expansion, and optimizes its industrial structure, AoFei Entertainment can still use its pan-entertainment strategy to achieve sustainable growth, so its risk score is relatively impressive.

Table 3. Final score

	Weight	09992.HK	002292.SZ	002438.SZ	002878.SZ
Profitability	0.4469	-80299.57	-128646872.87	-82406399.97	-19263026.09
Growth	0.2600	-163370.63	-261729845.87	-167654399.97	-39190296.60
Risk	0.2930	47996.83	76892384.64	49254400.60	11513533.74
Final score		-64293.00	-103002696.07	-65979694.31	-15423178.31

This paper used a questionnaire to distribute the more generalized results as above. This method may provide more scientific advice to individual investors in the stock market. Investors can choose the relative degree of profitability, growth, and risk for a comprehensive stock score according to their preferences and perhaps get different results.

5. Conclusion

In this paper, we conduct macro analysis and industry analysis of China's tide play enterprises, select the financial indicators of four representative enterprises located upstream of the industry chain, use mathematical models to quantify the analysis, and conclude the following.

From a macro point of view, due to the stable situation of the epidemic, the economy shows a recovery trend, tide play enterprises are facing new opportunities for development; as China's tide-play enterprises continue to go global, the state continues to issue the corresponding preferential tax policies to encourage the development of tide play enterprises; industry standards continue to standardize, making the development of tide play enterprises in a more precise direction, the development environment is cleaner. The macro-environment faced by the tide play enterprises is very optimistic.

The tide play industry is currently dynamic; the market size is growing rapidly, the industry chain is becoming more and more perfect, each link of the industry chain operation continues to mature, and the division of labor continues to refine. At present, the competition pattern in the industry is relatively fragmented. In addition to the high market share of Bubble Mart, the rest of the market

share of enterprises is not very different; there are more gaps waiting for enterprises to tap. The tide play industry has greater development potential.

Finally, a large number of financial indicators were dimensioned down using factor analysis, and factor scores were obtained. The hierarchical analysis is then used to assign weights to each factor to obtain stock scores for ranking. Four listed companies in the same industry chain, focusing on upstream IP creation and operation, are selected for analysis. The stock scores are Bubble Mart > Yuanlong Yatou > Gaolak > AoFei Entertainment.

In terms of the overall specific score, investors who are less risk averse and pay more attention to the current profitability of the stock may choose to hold shares of Bubble Mart. In contrast, investors who pay more attention to growth and intend to hold the stock for a long time may choose to hold shares of AoFei Entertainment when it releases positive strategic signals. For more risk-averse investors, Yuanlong Yatou has a solid operating position and may choose to hold its stock.

On the one hand, the model established in this paper is conducive to the scientific processing of complicated financial index information, a more intuitive display of stock gaps, and convenient for analysts to use richer data to analyze the investment value of each enterprise, which can provide an effective reference for individual investors in the stock market while enhancing the financial inclusion. On the other hand, this study is conducive to investors' rational view of the investment value of tide play enterprises and promotes the benign development of the industry.

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