Valuation of the IoT Industry Based on Relative and Absolute Valuation Method

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Abstract: In recent years, the IoT industry has experienced an extremely rapid development which attracts large amounts of investors. In this case, a suitable valuation for such industry is necessary to offer some suggestions for investments. Applying the relative valuation method and the absolute valuation method to analyze the valuation of the Internet of Things industry, this article studies the data development of five leading companies in the industry and performs the discounted cash flow valuation method on Hikvision, with the aim of providing regulatory advice to listed companies and providing investors with a basis for decision making. The results show that the overall development trend of the industry is found to be good at present, and the cash flow is in the state of increasing year by year but diminishing margin, but there may be a downward trend and the industry still has some room for growth in the future. These results shed light on guiding further exploration of IoT industry evaluation.

Keywords: Internet of Things, industry valuations, relative valuation method, absolute valuation method, DCF model

1. Introduction

Internet of Things (IoT) connects all things to the Internet across time, place and devices, extending human-to-human communication to human-to-object or object-to-object communication [1]. Providing a way to access information beyond various time, place and devices limited, and get the real-time information through connected devices solves problems in various areas of society [2]. With the outbreak of COVID-19, health workers used IoT to effectively monitor the situation of COVID-19 patients and regulate the epidemic, IoT attracted the attention of the general public [3, 4].

Many scholars have studied the valuation of IoT companies. Some scholars suggest that valuation methods such as the Venture Capital method, Dave Berkus method, Scorecard method and Risk Factor method can be used to value IoT companies [5]. Some scholars have made cases for valuation analysis of individual IoT companies for a single company, such as Midea Group, Hikvision

and Haier, using the P/E valuation method, EVA valuation method [6], DCF model, PEG valuation [7], Time Series Approach (ARIMA model and simple seasonal model) [8], FCFF model, B-S model [9], company valuation model (Company valuation = Valuation of operating assets + Fair value of financial assets + value of long-term equity investments) and equity valuation model (Equity value = Company value - Debt value) [10].

There are two main types of valuation methods for companies, relative valuation methods and absolute valuation methods. The common relative valuation methods include price-to-earnings (P/E), price-to-net (P/B), price-to-cash (P/CF), price-to-sales (P/S) and price-to-earnings growth ratio (PEG) [11-13]. The absolute valuation methods can more intuitively reflect the key driving factors of the underlying value, so the methods are more reliable in evaluating the intrinsic value of a stock [14]. In the absolute valuation method, the DCF model is a better way to evaluate the intrinsic value of stocks of the companies with higher research value and research space than the traditional valuation models [15].

The IoT is still in the initial stage in China and the growth rate is slow [16, 17]. After reviewing the existing literature both in China and internationally, IoT is an innovative industry, and there is still a gap in research on the current and future valuation of the IoT industry. It is necessary to research the valuation of the IoT industry. Moreover, based on the previous analysis of the research data, the authors believe that combining the analysis with the relative valuation methods and the absolute valuation methods can provide a more accurate analysis of the IoT industry valuation. Therefore, in this research paper, the authors take five listed companies in the IoT industry as an example and use five relative valuation ratios of the companies and the DCF model to value the IoT industry. The research has two main purposes. Firstly, provide some quantitative analysis of the actual situation of IoT industry valuation to provide a basis for investment decisions and reduce investment risks for investors. Secondly, provide some regulatory ideas for the SFC's supervision of listed companies. This research paper explores the development of the Internet of Things (IoT) by way of valuation, and it will address the following questions:

Previous studies are based on data of previous years, but this study uses the latest data to get more valuable results. This research is based on data from company annual report and stock of five companies, comparing their price-to-earnings ratio, price-to-book ratio, price-to-current ratio, price-to-sales ratio, and PEG data to analyze the current value situation of IoT. This research also uses DCF model to estimate the future valuation of Hikivision by analyzing its cash flow, using this company as a representative and thus estimate the industry value of IoT.

2. Methodology

This paper chooses to use high market capitalization companies and leading companies in the IoT industry as research objects, including five listed companies including Hikvision, Medea Group, Haier Smart Home, Unisplendour Corporation Limited, Ingenic. The data in this paper is obtained from the annual reports of five listed companies and the website of Flush Ask Finance. After collecting the data, two methods of relative analysis and absolute analysis are applied to value the companies.

In the relative valuation method, the market price per common share, annual earnings per common share, market capitalization, total assets, total liabilities, total market value of index constituents, net cash flow, sales revenue per share, and earnings growth ratio of each company are collected for the past five years, and the price-to-earnings ratio (PE), price-to-net ratio (PB), price-to-present ratio (PCF), price-to-sales ratio (PS), and price-to-earnings growth ratio (PEG) of each company are calculated. ratio (PEG), and compare these data horizontally.

In the absolute valuation method, one company, Hikvision, was selected as the research object, and the data collected on operating income, net income, depreciation and amortization expense,

capital expenditure, short-term borrowing, long-term borrowing, opening index, closing index, equity capital, and debt capital were used to derive the free cash flow, Weighted Average Cost of Capital, terminal value, and Enterprise Value, and use these data to analyze and forecast the future development of this company and the IoT industry.

Table 1: P/E ratio of five companies of IoT.

P/E	2018	2019	2020	2021	2022
Hikivision	20.77	24.43	33.46	28.91	25.31
Medea	11.97	16.18	25.05	17.70	-
Haier	11.45	15.12	21.80	21.20	15.48
Unisplendor Corporation Limited	26.72	35.11	30.98	30.47	26.01
Ingenic	260.71	300.52	435.67	69.02	42.95

3. Relative Valuation Methods

3.1. P/E Ratio

The P/E ratio is the price of a stock divided by the earnings per share. It is used to evaluate whether the stock of a company is overvalued or undervalued, and thus estimate its investment value. If a company's P/E ratio is too high, its stock is overvalued, so the investment risk of that company is high and its investment value is small. In other words, the investment value of companies with lower P/E ratio is higher. Table 1 shows that P/E ratio of Ingenic is the highest in all five years. Although its P/E ratio declined in the last three years, it is still high, so this company may not have too much investment value. The P/E ratios of other four companies all first increased and then declined. The P/E ratios of Hikivision and Unisplendor Corporation Limited are still high, showing that investment in them may have risks, while the P/E ratios of Medea and Haier are relevantly low, so they are more worth investing. In summary, P/E ratios of most of the five companies are declining, so the development prospect of IoT industry is good.

3.2. P/B Ratio

P/B ratio refers to the ratio of stock price per share to net asset value per share. The P/B ratio can evaluate the investment value of a stock. It is generally believed that the investment value of stocks with lower P/B ratio is higher. As shown in Table 2 the P/B ratio of five companies all first increased and then declined. Although the figure of Ingenic in 2019 was relevantly high, other figures are all below 10. This shows that all the five companies are worth investing, and the investment value and development prospect of IoT industry is also good.

Table 2: P/B ratio of five companies of IoT.

P/B	2018	2019	2020	2021	2022
Hikivision	6.26	6.73	8.32	7.47	4.05
Medea	2.66	3.78	5.57	3.82	-
Haier	1.51	1.89	3.55	3.25	2.35
Unisplendor Corporation Limited	1.49	1.99	1.77	1.83	1.48
Ingenic	3.21	14.26	5.22	6.25	3.01

Table 3: PCF ratio of five companies of IoT.

PCF	2018	2019	2020	2021	2022
Hikivision	22.35	34.01	24.41	37.55	31.31
Medea	8.62	10.24	22.80	14.37	-
Haier	4.41	8.16	10.46	8.12	7.66
Unisplendor Corporation Limited	1.85	38.00	11.67	-29.98	13.88
Ingenic	100.69	727.12	36.93	40.11	-382.63

3.3. PCF Ratio

PCF ratio is a stock's price to its cash flow per share. It can evaluate the investment value of a company. The appropriate range of PCF is between 0 and 25. Companies with good business operations and companies with large cash needs have PCF lower than this number, while the PCF of companies with less cash needs and less total assets are mostly higher than this number. Companies with proper PCF have smaller operating pressure and better investment value. Table 3 shows that PCF of Media and Haier float between 0-25, which emphasizes their small operating pressure and low stock risk. Whilst PCF of Hikivision and Unisplendor Corporation Limited floated in larger ranges, showing that investment on their stock is higher in risk than Medea and Haier, but they are still worth investment. PCF of Ingenic floated in a huge rage, so investment in it have the greatest risk. In summary, the IoT industry have a good investment value.

3.4. PS Ratio

PS ratio is sales per share dividing stock price. It is mainly used for GEM enterprises or high-tech enterprises. A PS ratio of 1 to 10 is reasonable, and the smaller the ratio, the more likely the stock is to be worth investing in. Table 4 shows that the three companies Medea, Haier and Unisplendour Corporation Limited have small PS ratios, showing that they are worth investing. The PS ratio of Hikivision is between 1-10, it also has investment value. PS of Ingenic was mostly higher than 10 but it has declined for the last three years and finally went below 10, so it also has potential investment value. In summary, it has great investment value, and its development is good.

Table 4: PS ratio of five companies of IoT.

PS	2018	2019	2020	2021	2022
Hikivision	4.77	5.31	7.13	6.00	3.93
Medea	0.95	1.46	2.43	1.51	-
Haier	0.48	0.64	1.26	1.23	0.95
Unisplendor Corporation Limited	0.94	1.19	0.98	0.97	0.75
Ingenic	14.15	51.88	19.76	12.24	6.27

Table 5: PEG of five companies of IoT.

PEG	2018	2019	2020	2021	2022
Hikivision	1.17	2.63	5.15	1.14	1.18
Medea	0.80	0.85	2.53	3.64	-
Haier	1.40	1.28	3.84	0.60	1.59
Unisplendor Corporation Limited	3.32	4.83	12.18	1.65	53.17
Ingenic	1.63	0.90	23.64	0.07	-2.35

3.5. PEG Index

PEG index is the result of a company's earnings growth rate dividing its P/E ratio. It is developed on the basis of P/E valuation, and it makes up for the PE to the lack of dynamic growth estimate. Stocks with PEG greater than 1 may be overvalued, while stocks with PEG less than 1 may be undervalued. Table 5 shows that PEG of Unisplendor Corporation Limited is relevantly high, so it's stock may be overvalued. The other four companies have similar PEG, and this ratio of them all first increased and then declined, but the figure of Ingenic in 2020 is abnormal. This shows that the IoT industry has a good development.

In summary, among the five companies Medea and Haier have higher investment values. The investment value and development prospect of IoT industry is good.

4. Absolute Valuation Method

The absolute valuation method selected in this paper is to value the future cash flows of one of the companies using a discounted cash flow model (DCF). Since Hikvision has a high market capitalization in the industry, Hikvision will be the main object of study for the absolute valuation method. Discounted cash flow (DCF) valuation model is a widely used method in the financial industry to evaluate a company by discounting all cash flows of the company in its future existence to today, and the value obtained is the intrinsic value of the company. In this paper, the collected data of Hikvision from 2015 to 2022 and the forecasted future data are analyzed, from which the free cash flow of Hikvision is calculated, after which the data is analyzed and finally the enterprise value of Hikvision and the trend of the IoT industry is evaluated.

4.1. Data Interpretation

Free cash flow is the main object of study in this section. As the free cash available in a company, it is of great significance to the development and operation of the company, and the company can use

free cash flow to develop new products, repay debts and other business strategies, while free cash flow can also reflect the intrinsic value of the company, and the higher the free cash flow, the higher will be the intrinsic value of the company. The free cash flow can be retrieved from Iwencai and CNINF.WACC is a weighted average of a cost and a required return [18]. WACC is a discount rate widely used in corporate finance [19]. The WACC method has an important value in the evaluation of Hikvision and the IoT industry The formula of WACC is:

$$WACC = \frac{E}{E+D} \times R_e + \frac{D}{E+D} \times R_d \times (1 + T_c) \qquad (1)$$

The formula for WACC reflects that the size of WACC depends on the cost of equity *(Re)*, the cost of debt *(Rd)*, the corporate tax rate *(Tc)* and the capital structure with the company (*E* is the market value of the firm's equity, *D* is the market value of the firm's debt).

When a company's shares are listed on an exchange, there is no specific cost paid for the company's shares, but this has a cost of equity actually [20]. The CAPM Model is generally used to value the cost of equity [21]. The CAPM model is calculated as:

$$R_e = R_f + \beta \times (R_m - R_f) \qquad (2)$$

R_f is $(Risk - free\ Rate)$, $(R_m - R_f)$ is the market risk premium and β is the risk coefficient beta.

Risk free rate is the expected rate of return from investing in "risk free" securities. Because of the strong stability of treasury bonds, long-term treasury bonds (e.g., ten years or more) are also often used as a measure of "risk free". In this paper, China's 10-year government bonds from 2017 to 2021 are used as the measure of risk free rate, so the risk free rate is 3.60%. The industry risk factor is used to measure the correlation degree between individual risk and market risk. According to Yahoo's assessment of Hikvision, the Beta value of Hikvision for the past five years is 0.94. The market expected payoff ratio was measured by selecting the CSI 300 index data for a total of five years from 2017 to 2021, and the specific market expected payoff ratio was measured as shown in Table 6.

Therefore, the expected market payoff, Rm = 8.05%, results in a market risk premium of 4.45%. According to the CAPM modelthe cost of equity capital can be calculated as$R_e = R_f + \beta \times (R_m - R_f) = 3.6\% * 0.94(8.05 - 3.60) = 0.150588 = 15.06\%$. Hikvision's target capital structure (Table 7) is estimated based on the average of its debt and equity ratios from 2017-2021, with debt to total capital of approximately 52.84% and equity to total capital of approximately 47.16%. Based on the People's Bank of China's adjustment of the prevailing interest rate in RMB in 2015: 4.35% for up to and including one year, 4.75% for one to five years (including five years), and 4.90% for more than five years. Therefore, it can be derived.

Table 6: Expected return on the market from 2017 to 2021.

Year	Opening Index	Closing Index	Closing Index / Opening Index
2017	3313.95	4030.85	1.216327947
2018	4045.21	3010.65	0.744250608
2019	3017.07	4096.58	1.35780078
2020	4121.35	5211.29	1.264461887
2021	5212.93	4940.37	0.947714625
Geometric mean			1.080532546

Table 7: Analysis of Hikvision's debt structure from 2017-2021.

Year	2017	2018	2019	2020	2021	Average
Short-term borrowings (billion yuan)	0.97	34.66	26.40	39.99	40.75	/
Percentage of short-term borrowings (%)	0.17	0.89	0.36	0.67	0.55	52.84%
Long-term loans (billion yuan)	4.90	4.40	46.04	19.61	32.84	/
Percentage of long-term borrowings (%)	0.83	0.11	0.64	0.33	0.45	47.16%

Based on the capital structure of Hikvision from 2017 to 2021, the ratio of equity capital and debt capital to total capital was calculated separately, and the five-year equity capital E and debt capital D were found to have an average value of 60.7693% of equity capital and 39.2307% of debt capital. The changes of equity ratio and debt ratio from 2017 to 2021 are not very large and relatively smooth. Therefore, this paper uses the average values of 60.7693% and 39.2307% as the equity ratio and debt ratio for the forecast period to calculate the WACC for the forecast period. The final calculated WACC is 1.9187% (shown in Table. 8).

Table 8: Hikvision Capital Structure Analysis Table from 2017-2021.

Year	Equity capital	Debt capital	Total assets (yuan)	Equity Ratio	Debt Ratio
2017	306.04	209.67	515.71	59.34%	40.66%
2018	379.44	255.29	643.92	59.78%	40.22%
2019	454.73	298.85	753.58	60.34%	39.66%
2020	544.80	342.22	887.02	61.42%	38.58%
2021	653.95	384.7	1038.65	62.96%	37.04%

4.2. Data Analysis

The terminal value is the value of cash at a future time. This article forecasts the value of Hikvision for the next five years, so the terminal value used in this article is the value of Hikvision's cash flow in 2027. The formula for calculating the terminal value is:

$$TV = \frac{FCF_{t+1}}{(WACC - g)} \tag{3}$$

Based on this formula, Hikvision's 2027 terminal value TV is calculated to be 114.859 billion yuan. Enterprise value market value of the enterprise itself, but also the market assessment of the enterprise, this indicator is closely related to the internal financial decisions of the enterprise, which can reflect the ability of the enterprise to control risk, sustainable development, and operational liquidity. The formula for calculating the terminal value is:

$$EV = \frac{FCF_1}{(1+WACC)^1} + \frac{FCF_2}{(1+WACC)^2} + \cdots \ldots + \frac{FCF_n}{(1+WACC)^t} + \frac{TV}{(1+WACC)^t} \tag{4}$$

Based on the data obtained and the free cash discount model, the business valuation of Hikvision was calculated and Hikvision's business valuation was $92.695 billion.

According to the analysis, Hikvision has a high enterprise valuation of $92.695 billion, which shows that the company still has a high market share in the IoT industry in the future. However, at

the same time, during the analysis using the DCF valuation model, it can be found that Hikvision's FCF from 2023 to 2027 has an increasing trend and a marginal decreasing trend, and the discounted FCF value has a decreasing trend. This phenomenon is related to Hikvision's current unstable working capital increase, and represents the development trend faced in the industry. According to the development of cash flow, the future operating conditions of the IoT industry will increasingly decline. Based on the enterprise value, the IoT industry still has the potential to grow under the leading companies. With the continuous development of artificial intelligence, the industry competition of IoT will become increasingly fierce. To enable the future development of IoT, industrial innovation within the industry, cash flow management of the company, and the enhancement of enterprise value are particularly important.

5. Conclusion

In summary, this study analyses the current and future valuation of the IoT industry using both relative and absolute valuation methods. Both valuation methods indicate that the IoT industry is currently a high value investment. The absolute valuation method shows a marginal growth trend in FCF for the IoT industry represented by Hikvision after discounted cash flows. It keeps growing positively until 2027, it starts to decrease after 2027, and the IoT industry may tend to normalize in the future. This research provides valuation analysis of the IoT industry to provide decision making advice to investors and regulatory ideas to the SEC. However, the research still has some limitations. Firstly, the volatility of some of the research data selected is relatively high and may lead errors to the results. Secondly, all companies cannot be fully representative of the IoT. Most of the companies have developed by combining the IoT with other industries such as chips and home appliances, so the development of the selected companies will also be influenced by other industries' development.

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