Research on M&A Valuation and Synergy Effect Measurement of Artificial Intelligence Enterprises - Taking GigaDevice Company's M&A of Silead Company as an Example

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Abstract. With the support of national policies and the growth of market demand, the artificial intelligence industry has developed rapidly. In order to enhance enterprise value and competitiveness, mergers and acquisitions have become the choice of many artificial intelligence enterprises. In order to further explore whether M&A can have a positive impact on the development of artificial intelligence enterprises, this paper selects GigaDevice 's acquisition of Silead as a case to explore the M&A valuation and synergy effect measurement methods of artificial intelligence enterprises. Based on the business data before and after M&A, this paper makes a comprehensive analysis from three dimensions: static synergy effect, dynamic synergy effect and short-term synergy effect under event research method. The results show that M&A can promote the value of the company in the short term, but too high a premium may bring greater losses and risks to the company. Finally, based on the research results, this paper provides suggestions for mergers and acquisitions of artificial intelligence companies and provides reference for the development of the artificial intelligence industry.

Keywords: artificial intelligence, synergistic effect, mergers and acquisitions

1 Introduction

In recent years, with the development of high-tech industry, artificial intelligence is also developing rapidly. The scale of China 's artificial intelligence core industry is CNY 93.6 billion in 2020 and CNY 130 billion in 2021, an increase of 38.9 % year-on-year. Many industry giants choose to enter the field of artificial intelligence. With the expansion of artificial intelligence enterprises, mergers and acquisitions have become an important way to enhance their corporate value. Therefore, a reasonable assessment of the synergy effect of mergers and acquisitions of artificial intelligence enterprises is not only conducive to maximizing the interests of enterprises, but also conducive to promoting the better development of the artificial intelligence industry. Based on this, this paper takes GigaDevice 's acquisition of Silead as an example to explore the measurement methods of M&A valuation and synergy effect of artificial intelligence enterprises so as to provide empirical reference for the development of artificial intelligence industry.

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2 Literature review

H. Igor. Ansoff (1965) first put forward the concept of synergy effect, believing that the benefit of enterprises after M&A is greater than that of individual enterprise [1]. He pointed out that the acquirer and the acquired enterprise should effectively integrate resources in production and operation to achieve synergy. On this basis, Itami (1987) divided synergy into dynamic and static, pointing out that dynamic synergy is a combination of two strategic elements at different time points, while static synergy is a cross combination of strategic elements at the same time [2]. Subsequently, Weston (1990) proposed that the synergy effects of mergers and acquisitions can be divided into three aspects: management synergy, business synergy and financial synergy [3]. Andrea (2018) and other scholars roughly estimated whether the synergy effect can be generated after the merger and the size of the synergy effect, and believed that if the estimated synergy effect is large, the merger and acquisition activity should be implemented, and vice versa [4].

In the evaluation of M&A synergy effect, there are three main methods: event research method, financial index method and EVA index method. In the event study method, Albuquerque Junior Marcos (2021) and other scholars emphasized that M&A synergy plays an important role in the development of the industry by studying the impact of acquisition announcements on the company's cumulative abnormal returns [5]. In the financial index method, Cai Qiongyao (2020) and other scholars have studied the M&A performance of multinational enterprises and found that after integration, M&A has a positive synergy effect [6]. On the EVA index method, O 'Byrne (2016) compared the EVA index with the financial index, and found that EVA can reflect the value of the enterprise more truthfully [7].

3 Research methods

3.1 Static synergistic effect measurement method

Assuming that the net valuation of post-merger synergies is equal to the premium paid by the enterprise, the following formula can be derived:

Amount of M&A transaction = book value of target company+(total valuation of synergy effect–performance compensation) (1)

Net valuation of synergy effect = total valuation of synergy effect-performance compensation = Amount of M&A transaction-book value of target company = premium of M&A payment (2)

3.2 Dynamic synergistic effect measure method

In the 1980s, Michael Jensen and other scholars first proposed the concept of free cash flow. Free cash flow refers to the difference between the cash flow generated by an enterprise 's operating activities and the capital expenditure, which can be used to measure the cash actually held by the enterprise that can return shareholders. This model is the most commonly used method for enterprise value evaluation.

The two-stage free cash flow discount model is shown in Formula 3:

$$V_{SYN} = \sum_{t=1}^{x} \frac{\Delta FCFF_t}{(1+WACC)^t} = \sum_{t=1}^{m} \frac{\triangle FCFF_t}{(1+WACC)^t} + \frac{\frac{\Delta FCFF_m \times (1+g)}{WACC - g}}{(1+WACC)^m} \quad (3)$$

Among them, V_{SNY} is the synergistic effect value for Silead after the merger; $\Delta FCFF_t$ is the free cash flow increment brought by M&A to Silead; $WACC$ is the weighted average cost of capital; m is the length of the first-stage forecast period, and g is the long-term sustainable growth rate of the free cash flow increment brought by the synergy effect in the second stage after the merger.

3.3 Short-term synergistic effect measurement method

The measurement of short-term synergy effect is based on the event study of capital market reaction before and after M&A announcement. By studying the changes of stock prices and stock returns before and after the event, the event study method can measure whether the stock price fluctuation is related to the event, and can also test the degree of abnormal reaction of information disclosure. The event study method is based on the efficient market hypothesis. Therefore, this paper assumes that the stock price can reflect all known public information, investors are rational, and investors' response to new information is also rational.

According to the daily closing price of the stock during the estimation window period, the stock yield and market yield are calculated:

$$R_{it} = \left(\frac{p_{it}}{p_{it-1}} \right) - 1 \quad (4)$$

$$R_{mt} = \left\{ \frac{MP_t}{MP_{t-1}} \right\} - 1 \quad (5)$$

R_{it} is the stock yield, p_{it} is the closing price of the day, p_{it-1} is the closing price of the day before. R_{mt} is the market yield. Since GigaDevice is listed on the Shanghai Stock Exchange, R_{mt} selects the return rate of the Shanghai Composite Index. MP_t represents the closing index of the Shanghai Composite Index on the day, and MP_{t-1} is the closing index of the previous day of the Shanghai Composite Index.

For example, on October 10, 2017, the closing price of GigaDevice 's stock was CNY 135.91, and its closing price on October 9 was CNY 134.91. The stock yield on October 10 was calculated as (135.91 / 134.91) -1, retaining four decimal places, and the result was 0.0074. The closing index of the Shanghai Composite Index on October 10,2017 is 3382.988, and its closing index on October 9,2017 is 3374.378. The market yield is calculated as (3382.988 / 3374.378) – 1, retaining four decimal places, and the result was 0.0026.

The abnormal return (AR) is the difference between the stock yield and the market yield. The calculation formula is as follows:

$$AR_{it} = R_{it} - R_{mt} \quad (6)$$

The cumulative abnormal return (CAR) is calculated as follows:

$$CAR_{it} = \sum (AR_{it}) \tag{7}$$

4 Empirical research

4.1 Case company selection

GigaDevice was founded in 2005, and successfully listed on the Shanghai Stock Exchange in 2016. GigaDevice is a fabless semiconductor company, mainly engaged in the development of advanced memory technology and IC solutions. The company's core product lines are FLASH, 32-bit universal MCU and intelligent human-computer interaction sensor chips. It is the main chip supplier in the fields of consumer electronics, Internet of Things, and mobile terminal products. In China's SPINORFLASH market, GigaDevice has a high share and is also one of the top three suppliers in the world.

Silead was established in 2011, mainly engaged in the development and sales of touch chips. At present, the company's main business includes touch products and fingerprint products, both of which are intended for the world's high-end mobile phones and other mobile Internet terminal equipment. In 2012 and 2013, Silead won the honorary title of China's most growth of integrated circuit design enterprises issued by China Semiconductor Industry Association. In 2017, it became the world's third-largest supplier of fingerprint chips and the world's fourth-largest supplier of capacitive touch chips.

4.2 Measurement analysis of static synergy effect

According to the 'Asset evaluation report' released by GigaDevice, the book value of Silead in 2018 was CNY 99 million. GigaDevice finally paid a transaction price of CNY 1.7 billion. The performance compensation was CNY 226 million.

Based on the static synergy effect measurement formula, the calculation shows that the expected synergy effect valuation of GigaDevice 's acquisition of Silead in 2018 is CNY 1.827 billion, and the net synergy effect valuation is CNY 1.601 billion, which is the premium paid for mergers and acquisitions. As of October 31,2017, the book value of Silead was CNY 99 million, so the premium paid by GigaDevice was about 16 times the book value of Silead.

4.3 Measurement analysis of dynamic synergy effect

The two-stage free cash flow model is based on the two-stage development model of company. It is assumed that 2019-2023 after M&A is the first stage, and the enterprises grows rapidly; after 2024 for the second phase, enterprises continue to grow steadily. In the first stage, the enterprise is in a period of rapid growth, assuming that the growth rate of sales is 10%; in the second stage, the enterprise enters the sustainable growth period and maintains balanced growth. It is assumed that the sales growth rate at this stage is 5 %, and the long-term growth rate of free cash flow increment brought by the synergy effect of M&A is 3%. Specific parameter model settings are shown in Table 1.

Table 1. Parameter model settings

Parameter	Before M&A	After M&A	Reference
WACC	——	7.83%	Estimated by reference to capital market data of similar enterprises based on the ratio of debt to equity in the company's total assets
Integration Period M	5years	5years	
Growth Rate of Sales Revenue in Consolidation Period	7%	10%	Estimated based on average data for the last 2 years
The Ratio of Cost to Sales Revenue	85%	82.5%	Estimated based on average data for the last 2 years
Ratio of R & D and Sales and Management Expenses to EBITDA	——	92%	Estimated based on average data for the last 2 years
Interest Tax to EBIT Ratio	——	43%	Estimated based on average data for the last 2 years

Based on the above parameter settings, the synergistic effect valuation calculated according to the multi-period free cash flow discount model is shown in Table 2:

Table 2. Estimation Results of Present Value of Synergistic Effect

Prediction Period	0	1	2	3	4	5	6
Year	2018	2019	2020	2021	2022	2023	2024
Sales Revenue after M&A	1.76	1.93	2.12	2.34	2.57	2.83	2.97
Sales Revenue before M&A	1.76	1.88	2.01	2.15	2.30	2.46	2.51
Sales Revenue Growth		0.05	0.11	0.19	0.27	0.37	0.46
Post-merger Sales Costs		1.59	1.75	1.93	2.12	2.33	2.45
Non-merger Sales Costs		1.64	1.81	1.99	2.19	2.40	2.52
Sales Cost Savings		0.05	0.05	0.06	0.06	0.07	0.07
Increased EBITDA after M&A		0.10	0.17	0.24	0.33	0.44	0.53
R & D and Sales and Management Costs (-)		0.09	0.15	0.22	0.31	0.40	0.49
EBIT Increase after M&A		0.01	0.01	0.02	0.03	0.03	0.04
Income Tax and Interest Increase (-)		0.00	0.01	0.01	0.01	0.01	0.02
Increase in Net Profit after M&A		0.00	0.01	0.01	0.02	0.02	0.02
Performance Compensation (+)		0.00	2.26	0.00	0.00	0.00	0.00
Free Cash Flow Increment from M&A		0.00	2.27	0.01	0.02	0.02	0.02
Growth Rate of Sales Revenue after M&A		10%	10%	10%	10%	10%	5%
Growth Rate of Sales Revenue before M&A		7%	7%	7%	7%	7%	2%
Ratio of Cost to Sales Revenue after M&A		82.5%	82.5%	82.5%	82.5%	82.5%	82.5%

Ratio of Cost to Sales Revenue before M&A		85%	85%	85%	85%	85%	85%
Ratio of R&D and Sales and Management Costs to EBITDA		92%	92%	92%	92%	92%	92%
Interest Tax to EBIT Ratio		43%	43%	43%	43%	43%	43%
Long-term Growth Rate of Free Cash Flow Increment Caused by M&A Synergy after Integration							3%
Weighted Average Capital Cost (WACC)	7.83%						
Net present Value of Free Cash Flow (19-24)	1.99	0.00	1.95	0.01	0.01	0.01	
Net Present Value of Final Value of Free Cash Flow Increment Brought by Merger	0.33						0.33
Value of Synergistic Effect	2.32						

From 2019 to 2023, the present value of the synergy effect in the growth stage of the enterprise is CNY199 million. After 2024, the company enters a stable and balanced development stage. During this stage, the net present value of the discounted free cash flow brought about by the synergy effect of M&A is CNY33 million, and the total synergy effect is CNY232 million. During the period, the premium paid by GigaDevice for Silead was CNY1.601 billion. The premium far exceeded the total valuation of the synergy effect calculated. GigaDevice may face business development risks due to the high premium paid. In addition, GigaDevice and Silead made a performance commitment agreement in the M&A activity. The performance commitment requires Silead to accumulate net profit of more than CNY321 million in the three years from 2018 to 2020, and the final completion rate of Silead is only 73 %. The high performance commitment in the gambling agreement also risks the development of Silead.

4.4 Analysis of Short-term Synergy Effect Measurement

On January 30,2018, GigaDevice passed the merger and acquisition proposal for Silead for the first time and released it to the public. Therefore, the benchmark date of the incident was January 30,2018. Since the stocks of GigaDevice were suspended from November 1,2017 to March 1,2018, the event date was extended to March 2,2018. Excluding the trading halt date and statutory rest date of GigaDevice, the final event window period is determined to be from October 9,2017 to October 31,2017, and from March 2,2018 to March 29,2018, recorded as (-16, + 20).

According to the short-term synergistic effect measurement formula, the following data are calculated in Table 3:

Table 3. stock yield and market yield

	Transaction Date	R_{it}	R_{mt}		Transaction Date	R_{it}	R_{mt}
-16	2017/10/10	0.0074	0.0026	3	2018/3/7	-0.0093	-0.0055
-15	2017/10/11	-0.0532	0.0016	4	2018/3/8	-0.0153	0.0051
-14	2017/10/12	0.0033	-0.0006	5	2018/3/9	0.0144	0.0057

-13	2017/10/13	0.0161	0.0013	6	2018/3/12	0.1000	0.0059
-12	2017/10/16	-0.0158	-0.0036	7	2018/3/13	0.0210	-0.0049
-11	2017/10/17	-0.0170	-0.0019	8	2018/3/14	-0.0211	-0.0057
-10	2017/10/18	-0.0037	0.0029	9	2018/3/15	0.0361	-0.0001
-9	2017/10/19	-0.0843	-0.0034	10	2018/3/16	-0.0483	-0.0065
-8	2017/10/20	0.0260	0.0025	11	2018/3/19	0.0767	0.0029
-7	2017/10/23	0.0487	0.0006	12	2018/3/20	-0.0096	0.0035
-6	2017/10/24	-0.0077	0.0022	13	2018/3/21	-0.0447	-0.0029
-5	2017/10/25	0.0065	0.0026	14	2018/3/22	-0.0591	-0.0053
-4	2017/10/26	0.0799	0.0031	15	2018/3/23	-0.0275	-0.0339
-3	2017/10/27	0.0058	0.0027	16	2018/3/26	0.0667	-0.0060
-2	2017/10/30	0.1000	-0.0077	17	2018/3/27	0.0368	0.0105
-1	2017/10/31	0.0974	0.0009	18	2018/3/28	-0.0054	-0.0140
1	2018/3/5	0.1000	0.0007	19	2018/3/29	-0.0203	0.0122
2	2018/3/6	0.0616	0.0100				

Using the formula to calculate the abnormal return and cumulative abnormal return of GigaDevice, and draw the trend chart as Fig. 1.Market Reaction:

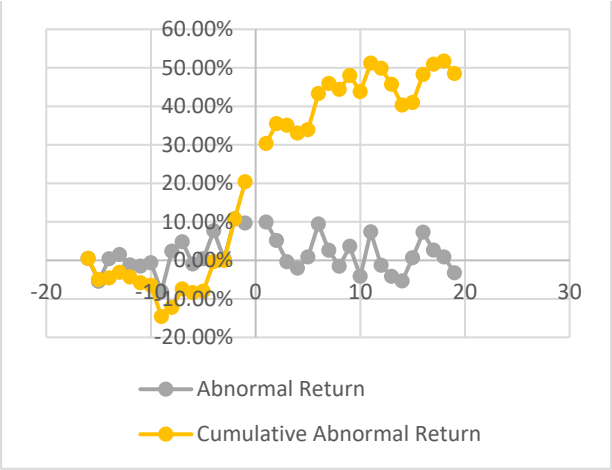

Fig. 1. Market Reaction

In Fig1, return is the gain or loss of a security in a particular period. The return consists of the income and the capital gains relative on an investment and is usually quoted as a percentage. The abnormal return is the difference between the stock yield and the market yield. The cumulative

abnormal is the simple sum of the monthly abnormal return of each stock during the formation period.

By observing the trend of the chart, it can be seen that from 16 to 6 days before the event period, the abnormal return of GigaDevice fluctuated slightly around the value of 0, while the abnormal return continued to be positive 5 days before the event date. At the same time, the fluctuation range became larger, indicating that the M&A information may have been leaked a few days before the announcement, and the market responded positively to the M&A event of GigaDevice. At the same time, the cumulative abnormal return in the days before the merger continued to rise sharply and remained positive, indicating that investors have a positive attitude towards the merger. After the stock resumption of GigaDevice, its cumulative abnormal return continued to grow and remain above 30 %, indicating that the mergers and acquisitions have a positive role in promoting enterprise value in the short term.

5 Conclusions

This paper adopts three methods to measure the synergy effect. The results show that in the case of successful mergers and acquisitions, the net valuation of synergies that GigaDevice can obtain is expected to be CNY 1.601 billion. In the event study method, it can also be seen that the market has a positive response to the merger and acquisition event, which has promoted the value of GigaDevice in the short term. However, through the discounted free cash flow method, it can be seen that the valuation of M&A synergies is much lower than the premium paid by GigaDevice for M&A, and paying too high a premium may bring great losses and risks to the company. This tendency can be seen from GigaDevice's provision of CNY 128 million for impairment of goodwill formed by the merger in 2020.

Many literature studies have also shown that mergers and acquisitions do not bring much synergistic benefits to the acquirer, resulting in the so-called " Winner's Curse, " " The synergy trap " or " The post-merger performance puzzle. " Therefore, the acquirer should do a good job in due diligence when deciding to merge, make a reasonable valuation of the acquired party, and adopt various methods to measure the synergy effect of M&A, so as to avoid losses and risks due to excessive premiums.

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