Valuation Analysis of Listed Brand Jewelry Companies Based on Free Cash Flow Model——Taking Zhou Dasheng (stock code 002867) as an example

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ABSTRACT
Unsuccessful acquisitions usually occur in China's jewelry industry. Because of this, according to the characteristics of the jewelry industry, this paper selects the free cash flow model to measure the value of the entity. Taking Zhou Dasheng company as an example, this paper introduces it by using Porter's five forces model. According to the historical free cash flow data, the Grey system prediction model GM(1,1) forecasts the free cash flow in 2021-2024. This article comes up with an assumption where the free cash flow will grow at a constant rate after 2024. Sequentially, using these future free cash flow discounts to the present.
Comparing the market value of Zhou Dasheng with the value of the entity which was measured by the free cash flow model. When the market value is lower than the value of the entity, the shareholder should buy more Zhou Dasheng's shares. On the contrary, the shareholder should sell this company's shares.

Keywords: *Financial forecasting, Jewelry industry, The value of the entity, Free cash flow model*

1. INTRODUCTION

China's jewelry industry is active in mergers and acquisitions, and industrial mergers and acquisitions have two major directions.

One direction is to add brand historical and cultural heritage and brand stories to the industrial chain through international acquisition, so as to increase the brand value of Chinese jewelry companies. For example, Chow Tai Fook, a Hong Kong listed company, acquired the American luxury brand Hearts On Fire in 2014, Gangtai holdings acquired the Italian luxury brand BUCCELLATI in 2017, and the Belgian luxury brand leysen1855 of Tongling jewelry in 2017.

The other direction in the industry is to launch mergers and acquisitions, and to realize the expansion of channel scale through the integration of resources between enterprises. There are still a large proportion of acquisition cases due to early cash flow forecasts and subsidiary valuation errors that caused the parent company to encounter a financial crisis or even bankruptcy and delisting. For example, Jinyi Culture acquired all or part of the shares of Jinyi Jewelry, Gefu Jewelry, Zhenbaotong, and Guitian Diamond from 2013 to 2017. It was an unsuccessful case where mergers and acquisitions failed due to financial problems. From 2014 to 2017, the net cash flow of Jinyi culture's operating activities continued to be negative, which were -0.67 million and -2.71 million respectively -524 million, -1.462 billion yuan. The valuation, financing, payment, and integration risks of Jinyi Culture during the merger and acquisition process had not been well measured. Another failure is the acquisition plan of Gangtai Holdings which announced the termination of the restructuring plan on August 13, 2018, which is due to the company's cash flow problems. So, the evaluation problem will cause a serious financial crisis.

In order to avoid financial crisis, choosing accurate and appropriate financial forecasts and company valuation models to obtain relatively correct financial values is conducive to debt financing and equity financing. Besides, by evaluating the value of the enterprise, investors can speculate whether the target company is worth investing in, and the management level of the enterprise can judge whether it should adjust its business decisions. This shows the importance of

financial forecasts and company valuations. However, the traditional method is based on accounting profits. When evaluating the value of an enterprise, indicators such as the cost of equity capital is often ignored, which makes it impossible to reflect the true value of the enterprise.

The free cash flow model solves the problem that people who lack professional knowledge cannot understand it. This method is used to realize the effective valuation of listed brand jewelry companies.

2. ANALYSIS OF VALUATION METHODS FOR CHINESE JEWELRY COMPANIES

2.1. The status quo and characteristics of China's jewelry industry

According to De Beers' 2021 Diamond Industry Insight Report, China's diamond consumption in 2020 has increased to 30% in carat weight and consumption, and online jewelry sales on Taobao and JD will increase to 49% on a yearly basis. The proportion of Chinese consumers who learn about jewelry online has increased to 35% in 2020 [1]. As the proportion of China's jewelry sales in the world's total sales increases, China's jewelry market has an increasingly greater influence on the entire jewelry industry. The operating model of online sales is accepted by more and more consumers.

China's jewelry industry is very different from other countries' industries, and its characteristics are as follows. Firstly, the pricing of the jewelry is higher than common goods. The price of products in the jewelry industry is high. In addition to the scarcity and hard-to-obtain raw gemstone, design, and processing also add higher value to jewelry. In other words, the value of jewelry products is a combination of tangible and intangible values.

Secondly, it was mentioned that the intangible value brought by design and processing to jewelry products can be huge. A good jewelry designer needs to master geology, and be familiar with jewelry characteristics, high aesthetics, and strong drawing ability. The cost of training a good jewelry designer is also higher than that of designers in other industries. Jewelry manufacturers need to expand the company's talent pool as the company expands. Therefore, the sunk cost of jewelry manufacturers of product production is also high.

Thirdly is about the uneven distribution of jewelry companies. The heat map of the distribution of major production bases in mainland China in 2020 compiled by the Prospective Industry Research Institute [2] shows that most of the jewelry processing enterprises in mainland China are located in developed coastal areas with high per capita GDP such as cities in Guangdong, Shandong, Shanghai, Fujian, and Zhejiang. Guangdong is the country's main jewelry production base, while Shenzhen and Panyu are the main jewelry processing centers. In regions with low per capita GDP, such as Inland China and Northeast China, there are fewer jewelry companies.

2.2. Determine the value evaluation model of the jewelry company

2.2.1. Multiples-based methods

This method is to select an appropriate multiple from comparable companies and multiply it by the driving factor, which is usually based on the accounting items of the target company.

The calculation method is shown in formula 1

$$\text{value estimate}_i = \text{Driver}_i \times \text{Multiple derived from comparable firms} \quad (1)$$

Firm i is the firm that is being valued as the target firm.

At entity level, the Multiple derived is usually represented by some ratios. Such as, EV/NOPAT (Entity Value/ Net operating profit after Tax), EV/EBIT(Entity Value/ Earning Before Interest and Tax), EV/sales(Entity Value/Sales), EV/NOA (Entity Value/Net Operating Assets), EV/IC (Entity Value/Invested Capital)[3]

It is easy to choose Multiple derived , which is typically the mean or median of the ratio. However, it is difficult to select a suitable comparable firm. In 2.1 about the status and characteristics of the Chinese jewelry industry, it is mentioned that the value of jewelry products is composed of tangible value and Intangible value composition. It is more difficult to measure the intangible value of branded jewelry companies than tangible value, and it is very difficult to find exactly the same comparable firm. Therefore, it is easy to make mistakes in multiples-based methods to choose inappropriate comparison companies, which leads to the wrong valuation of the target firm.

2.2.2. Absolute valuation method

2.2.2.1.Discounted-abnormal-profit valuation—entity perspective

The net operating asset of year N plus the abnormal operating profit of year N+1 is the net operating asset of year N+1. Therefore, in year 0, that is, the original, the annual abnormal operating profit after the accumulation of net operating asset is discounted to the first. The value of year 0 is equal to the value of the operating item in year 0, and the value of the entity. The calculation method is shown in formula 2

$$V_0^F = NOA_0 + \sum_{t=1}^{\infty} \frac{AOP_t}{(1+WACC)^t} \quad (2)$$

NOA_0 (Book value of net operating asset),

AOP $_t$(Abnormal operating profit) as net operating profit after tax less a capital charge based on opening book value.

Since the perspective of the appraisal subject of discounted abnormal profit is the annual discount based on abnormal operating profit, the financial information of China's jewelry listed companies such as profit is easy to be manipulated, and the appraisal subject of discounted abnormal profit cannot be used. Therefore, the value of entity obtained from the prospective analysis of the financial statements of listed branded jewelry companies is not an accurate measurement method.

2.2.2.2.Free-cash-flow valuation model

This values the operating entity by valuing expected future operating cash flows(net of investment in operating assets), termed "free cash flow". The calculation method is shown in formula 3

$$FCF_t = NOPAT_t + Depraciation_t - \text{Net Abbition}_t - \text{increase in working capital}_t \quad (3)$$

Net Abbition$_t$ refers to the increase of PPE (property, plant and equipment) minus the disposal income.

Because of the steady development trend of China's jewelry industry, assuming that free cash flow increases at a steady growth rate g from year n, then accumulates the discounted future cash flow from year 0 to get the value of the operating item which is also equal to the value of the entity. The calculation method is shown in formula 4.

$$V_0^F = \sum_{t=0}^{\infty} \frac{FCF_t}{(1+WACC)^t}$$

$$\text{Assume steady growth g} = \sum_{t=0}^{n-1} \frac{FCF_t}{(1+WACC)^t} + \frac{\frac{FCF_n}{WACC-g}}{(1+WACC)^{n-1}} \quad (4)$$

Based on the status quo of the stable and sustainable development of China's jewelry industry, reasonable assumptions are made to effectively predict future changes in cash flows. The value of entity obtained is relatively accurate and valid.

3. ZHOU DASHENG JEWELRY ENTERPRISE VALUE EVALUATION CASE

3.1. Analysis of Zhou Dasheng's Enterprise

Zhou Dasheng's first physical offline store was born in the Wangfujing Department Store in Beijing in 1999, and Zhou Dasheng has officially entered the jewelry industry in Mainland China. After years of development, it was listed on the Shenzhen Stock Exchange in 2017 with the stock code 002867[4]. With a number of physical offline stores and multi-platform online flagship stores "dual-line sales" model, Zhou Dasheng occupied a larger market share in China. Zhou Dasheng has become a mainstream mid-to-high-end jewelry brand in China.

The Porter's Five Forces Model introduces the brand-based jewelry company Zhou Dasheng.

Figure1: Porter's Five Forces Model

Rivalry among existing competitions

Compared with companies of the same brand in the same industry, Zhou Dasheng has a higher share of the Chinese jewelry market. The "Shuibei • China Jewelry Index" shows the market share of major brands in the Chinese jewelry market, of which Zhou Dasheng accounted for 4.30% (the third-largest branded jewelry company in China). The comparison includes the first two brands listed on the Hong Kong stock market (Chow

Tai Fook and Lao Fengxiang). Chow Tai Sang has more young customers and better brand innovation and development potential.

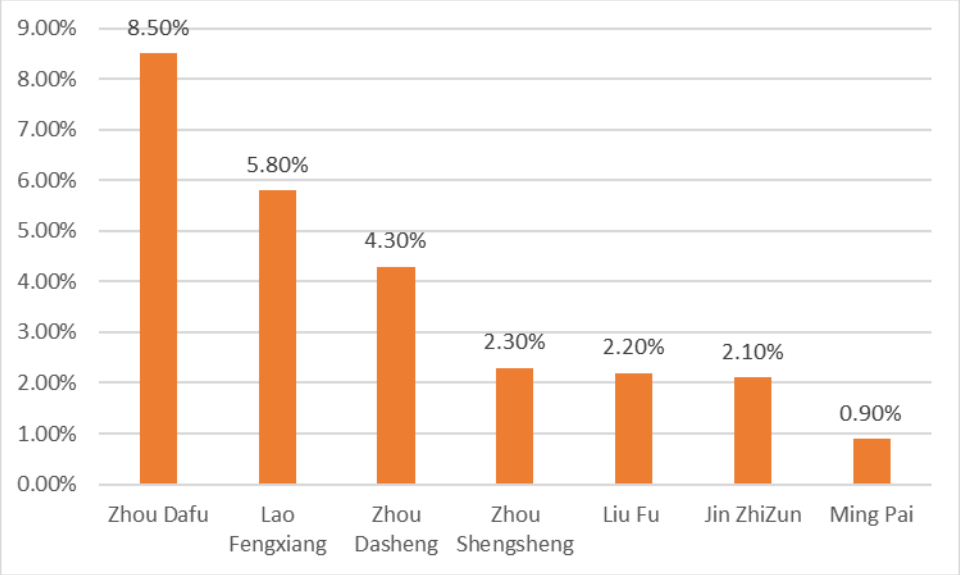

Figure2: a bar chart of Chinese brand jewelry enterprises in the Chinese market[2]

The threat of new entrants

From the perspective of industry practitioners, raw material processors enter the brand-based jewelry industry and directly conduct private customization with customers to design unique jewelry products that are cheaper than brand-based jewelry companies. Customers are more willing to choose this high-quality and inexpensive way, and raw material suppliers can also obtain higher profits. From the perspective of entry barriers, the reduction of entry barriers for the Chinese jewelry industry has promoted other foreign brand-type jewelry companies (such as Cartier, Tiffany) to enter the Chinese jewelry market.

Threat of substitute products of services

Artificial gemstones replace natural gemstones. The man-made diamonds can be taken as an example. Man-made diamonds are also called cultivated diamonds. They are artificially cultivated in the laboratory with carbon elements, which are almost identical in physical and chemical properties to natural diamonds. If there is no professional scientific instrument, it cannot be distinguished by the naked eye. The cost of synthetic gems is lower than that of natural gems. In terms of price, synthetic gems have more advantages.

Bargaining power of suppliers

The raw materials for jewelry are gems such as diamonds, aquamarine, pink diamonds, yellow diamonds, etc. The suppliers of these raw materials are generally located in Australia, Zaire, Botswana, Russia, South Africa and other places. Gem production from these areas is low and can reach gem grade globally. Raw material processors have strong bargaining power.

Bargaining power of buyer

The purchase of jewelry is generally emotional consumption. Due to the lack of relevant knowledge of gem identification and evaluation and intangible value (such as design, processing technology and brand premium), customers' bargaining power is low.

3.2. Zhou Dasheng's enterprise value evaluation based on FCF model and grey system prediction model

3.2.1.Grey system theory predicts free cash flow of enterprises

Grey system theory is the first theory developed by renowned Chinese scholar Professor Deng Jilong in "Gray System Review". This model uses the collection and sorting of original data to find the law of its changes. Grey system prediction model GM(1,1)[3].

GM(1,1) principle：

Assuming the original sequences of 2010, 2015, and 2020 are $x_1^{(0)}, x_2^{(0)}, x_3^{(0)}$, respectively. Accumulating to generate a new sequence, $x_1^{(1)}, x_2^{(1)}, x_3^{(1)}$, among them[2][3]

Then generating the mean sequence: $z_k^{(1)} = \alpha\, x_k^{(1)} + (1-\alpha)x_{k-1}^{(1)}, k = 2,3$

In the formula, $0 \le \alpha \le 1$ is the weight. Usually mean series $\alpha = 0.5$. From this, the grey differential equation is established

$$x_k^{(0)} + az_k^{(1)} = b, k = 2,3 \quad (5)$$

After the shift

In terms of the Grey system prediction model GM(1,1), the prediction function is shown as follows.

$$\widehat{x_k^{(0)}} = \left(x_1^{(0)} - \frac{b}{a}\right) e^{-\alpha(k-1)}(1 - e^a), k = 2,3 \quad (6)$$

3.2.1.1.Forecast Zhou Dasheng's cash flow

After sorting out the annual reports of Zhou Dasheng Jewelry Enterprise for the past five years, the company's free cash flow from 2015 to 2020 is as follows: 379,485,336.10 yuan in 2016, 320,400,305.66 yuan in 2017, -14,451,958.72 yuan in 2018, 616,793,037.72 yuan in 2019, and 1,224,578,576.89 yuan in 2020. The annual free cash flow growth rates are: 0.28 in 2016, -0.16 in 2017, -0.15 in 2018, -43.68 in 2019, and 0.99 in 2020. After excluding the extreme growth rate in 2019, the weighted average free cash growth rate is 0.02.

Table 1 The free cash flow from 2016 to 2020

¥	2016Y	2017Y	2018Y	2019Y	2020Y
Free cash flow	379,485,336.10	320,400,305.66	-14,451,958.72	616,793,037.72	1,224,578,576.89
Growth rate	0.28	-0.16	-0.15	-43.68	0.99

The free cash flow of 2021-2024 is predicted by the gray system forecasting model GM(1,1)[4]. Supposing that starting from 2024, Zhou Dasheng will grow steadily with a weighted average free cash growth rate g=0.02.

Table 2 The forecast free cash flow from 2021 to 2024

¥	Forecast 2021	Forecast 2022	Forecast 2023	Forecast 2024
Free cash flow	383,787,716.34	173,891,249.53	78,788,781.86	35,698,588.42

The free cash flow prediction curve of the GM (1,1) of the gray system prediction model of Zhou Dasheng jewelry enterprise is shown in Figure 3

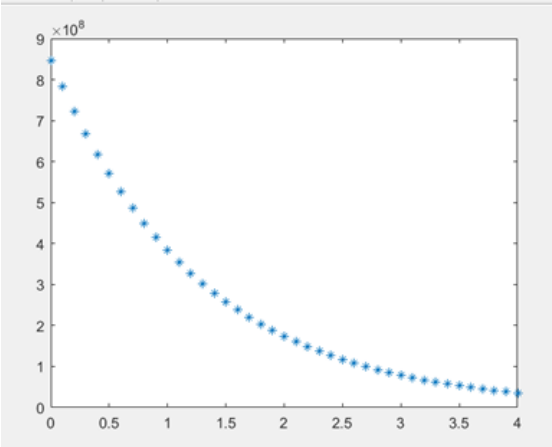

Figure 3：The free cash flow prediction curve of the GM (1,1) of the gray system prediction model of Zhou Dasheng jewelry enterprise

3.2.2 Determination of discount rate

The discount rate of free cash is equivalent to the cost of obtaining cash flow, and the source of corporate funds is obtained in two ways. One is to issue stocks to get investment from investors, and the other is to issue bonds to raise funds. Therefore, the discount rate of free cash flow should be equal to the company's weighted cost of capital (WACC)

$$WACC = R_{equity} \times W_{equity} + R_{debt} \times W_{debt} \times (1 - T) \quad (7)$$

WACC: weighted cost of capital R_{equity}:cost of equity R_{debt}:cost of debt

$$R_{equity} = R_f + \beta (R_m - R_f) \quad (8)$$

In this article, the risk-free rate of return selects the interest rate of the 10-year Treasury bond on December 31, 2020, which is the base date for evaluation, namely Rf=3.227%.

Using the geometric average method, the market risk premium of listed companies in the base ten years (ie each year from 2011 to 2020), and the average value of $R_m - R_f$at 6.65% are calculated; the β value selected in this paper is the value of Zhou Dasheng Jewelry. The five-year Shanghai Composite Index of enterprises from 2016 to 2020 is calculated monthly and found by Guotaian..The result is β =0.7563; the calculated formula is shown below.

$$R_{equity} = 3.227\% + 6.65\% * 0.7563 = 8.2563\%$$

The loan interest rate announced by the People's Bank of China[5] is usually used to determine the debt capital of the enterprise, so the cost of debt capital$R_{debt} = 4.75\%$.Tax rate $T = 25\%$

After sorting out the average D/E ratio of Cathay Pacific's Zhou Dasheng from 2017 to 2020, the author get $W_{equity} = 0.4862$，$W_{debt} = 1 - 0.4862 = 0.5138$

Bringing the above data into formula, the weighted average cost of capital is received.

$$\text{WACC} = 8.2563\% \times 0.4862 + 4.75\% \times (1 - 25\%) \times 0.5138 = 5.84\%$$

3.2.3. Estimation of the overall value of the enterprise

An enterprise cannot always be in the stage of rapid development, so after the first stage of rapid development, the enterprise will enter the second stage, that is, the stage of stable growth. After excluding Zhou Dasheng's extreme growth rate in 2019, the weighted average free cash growth rate is 0.02. Therefore, assume that after 2024, Zhou Dasheng's free cash flow will grow steadily at a growth rate of g=2%.

first stage

$$\text{NPV}_{S1} = \frac{\text{FCF}_{2021}}{(1+\text{WACCA})^1} + \frac{\text{FCF}_{2022}}{(1+\text{WACCA})^2} + \frac{\text{FCF}_{2023}}{(1+\text{WACCA})^3} \quad (9)$$

$$= \frac{383{,}787{,}716.34}{(1+5.84\%)^1} + \frac{3{,}787{,}716.34}{(1+5.84\%)^2} + \frac{383{,}787{,}716.34}{(1+5.84\%)^3}$$

$$= 584295127.9$$

Second stage

Based on a steady and sustainable growth rate of 2% after 2024.

$$\text{NPV}_{S2} = \frac{\frac{\text{FCF}_{2024}}{\text{WACC}-g}}{(1+\text{WACC})^4} \quad (10)$$

$$= \frac{\frac{35{,}698{,}588.42}{5.84\% - 2\%}}{(1+5.84\%)^4}$$

$$= 740833298.8$$

$$\text{NPV} = \text{NPV}_{S1} + \text{NPV}_{S1} = 584295127.9 + 740833298.8 = 1325128427$$

3.3. Investment value

As of the assessment base date on December 31, 2020, the investment value can be obtained through Chow Dasheng Enterprise's 2020 annual report. The total share capital is 1.096 billion shares, and the stock price is 18.27 yuan. That is, the market value is 20,023,920,000.00.

Based on the evaluation results, the current value of Zhou Dasheng's enterprise should be overestimated. Therefore, advisement buy this share at present unless the market value of the Zhou Dasheng is lower than the value of the entity measured by free cash flow model.

4.CONCLUSION

Based on the gray system forecasting model GM(1,1), this paper predicts Zhou Dasheng's free cash flow in the next 4 years. It used historical data with growing perpetuity 4 years later for prediction. It is found that the current value of Zhou Dasheng's enterprise is overestimated and is not suitable for long-term holding.

For jewelry practitioners, the Free cash flow model optimized by Grey system prediction model GM(1,1) will provide more accurate data for enterprise acquisition and investment.

For shareholders in the secondary market, the improved model will remind them to buy or sell the shares of Zhou Dasheng at the appropriate time.

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