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Enterprise Value Evaluation Based on DCF Model

- A Case Analysis of Hengrui Pharma

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Abstract: The pharmaceutical industry plays a critical role in the national economy, and the valuation of pharmaceutical companies is also a key concern for investors. There are many kinds of method to evaluate the company. We can use the Discounted Cash Flow (DCF) model and relative valuation methods, such as the Price-to-Earnings (P/E) ratio and Price-to-Book (P/B) ratio. The DCF model is a common model for company valuation. Therefore, in this paper, we evaluate the financial data of Jiangsu Hengrui Pharmaceuticals Co., Ltd from 2019 to 2023 by using the DCF model. We also show how to calculate the weighted average cost of capital (WACC) using the financial data and compare the actual intrinsic value with the result evaluated from the DCF model.

Keywords: Pharmaceutical industry, Stock valuation, Enterprise value evaluation, DCF model, Hengrui Pharma.

1. Introduction

The pharmaceutical industry is a vital component of China's national economy, integrating both traditional and modern industries. In recent years, due to the impact of the pandemic and economic recovery, the government has placed increasing emphasis on the development and revolution of the pharmaceutical industry. During the 19th National Congress of the Communist Party of China, the Party decided to carry out the "Healthy China initiative", which supporting the companies to enhance new drug and improve the technological levels. Additionally, the issue of population aging become increasingly severe nowadays. In 2022 and 2023, the elderly population aged 65 and above accounted for 14.9% and 15.4% respectively. It is expected that by around 2050, the proportion of elderly people will exceed 10%, which will inevitably increase the demand for pharmaceuticals. Therefore, the market space for the pharmaceutical industry in China continues to grow, and the industry outlook remains promising, making it meaningful to analyze and study its investment value.

Jiangsu Hengrui Pharmaceuticals Co., Ltd, founded in 1970, was listed on the Shanghai Stock Exchange in 2000. The pharmaceutical engages in areas such as oncology drugs, surgical drugs, cardiovascular diseases, metabolic disease and autoimmune diseases. In the "Top 25 Global Pharmaceutical Companies by R&D Pipeline Size" released by Informa Pharma Intelligence, Hengrui Pharma ranked 13th, setting a new high for Chinese pharmaceutical companies on the list. The company consistently prioritizes technological innovation as its primary development strategy,

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continuously increasing investment in R&D to develop more new and effective drugs, serving the "Healthy China initiative" and benefiting patients worldwide.

As one of the leading pharmaceutical companies in China, Hengrui Pharma is representative of the industry. Therefore, this paper uses Hengrui Pharma as a case study, selecting the Discounted Cash Flow (DCF) model as a method to evaluate the company's future stock value and provide investment advice to investors.

2. Literature Review

There are numerous stock valuation methods, which can generally be divided into relative valuation methods and absolute valuation methods. The relative valuation methods include the Price-to-Earning (PE) ratio, Price-to-Book (PB) ratio, Price-to-Sales (PS) ratio and so on. The absolute valuation methods include the Dividend Discount Model (DDM), Discount Cash Flow (DCF) Model, Residual Value Model, and Economic Value Added (EVA) Model, among others.

In recent years, scholars have conducted diverse research on company stock valuation models, continually innovating and optimizing these models to make them more scientific and practical.

Williams proposed the DDM, which is the cornerstone of the traditional stock pricing theory[1]. Rappaport proposed the DCF building onto Williams's research[2]. Gordon proposed two-stage DCF models[3]. Cassia etc also showed that two-stage DCF model was the most common model. The length of the first period of explicit forecast was important. The second stage assumed that the cash flows grow at a constant perpetual growth rate[4]. Li used traditional stock valuation models such as the DCF model and relative valuation models to evaluate the stock of Huadong Medicine and concluded that the stock price of the company was relatively reasonable[5]. Qi believed that the DCF model was suitable for companies in the early stages of development, with no significant profits or cash flows but with considerable growth prospects[6]. Wu used the DCF model to conduct quantitative analysis on Kelun Pharma and concluded that the DCF model was suitable for valuing listed pharmaceutical companies[7]. Liu used the DCF model to evaluate the stock of target companies in pharmaceutical mergers and acquisitions cases. The research showed that macro and micro environment analysis and target company situation analysis were key to determining the company's future free cash flow[8].

If we use the relative valuation methods to evaluate the stock value of Hengrui Pharma, it will be difficult to find suitable comparable companies. Moreover, considering the national condition and the changeable dividend policies, DDM isn't suitable either. So, based on the previous literature, this paper selects the DCF model to evaluate the stock value of Hengrui Pharma.

3. Stock Value evaluation based on the DCF model

The DCF model is a valuation model based on the income capitalization pricing method. It determines the intrinsic value of a company's assets through the cash flows generated by the company in future periods. Since these are future cash flows, they need to be discounted to present value at a certain discount rate. People usually use the company's weighted average cost of capital (WACC) as the discount rate. Depending on the specific circumstances of the companies being evaluated, the DCF model can be divided into different types, such as zero growth, fixed growth, two-stage growth, and three-stage growth.

In this paper, we use the two-stage DCF model for evaluation. This model is suitable for companies that experience high growth in one stage and then enter a stable growth stage in the following period. The specific formula is as follows:

$$V = \sum_{t=1}^{n} \frac{FCF_t}{(1 + WACC)^t} + \frac{FCF_{n+1}}{WACC - g} \times \frac{1}{(1 + WACC)^n}$$

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This evaluation apply the sales percentage method to predict various accounting elements. Hengrui Pharma will be valued as at December 31, 2023, using historical data from 2019-2023 as a reference value for prediction. We also assume that Hengrui Pharma will be in a high-growth stage from 2024-2028 and will enter a stable growth stage after 2028.

3.1. Free Cash Flow Prediction

Free cash flow is the amount of cash flow left after meeting investment needs in a given year. The "cash flow" above means the maximum amount of cash that can be distributed to capital suppliers without impairing the company's development. The formula is as follows: Free Cash Flow = EBIT * (1 - Tax Rate) + Depreciation + Amortization - Net Working Capital - Capital Expenditures.

EBIT refers to the earning before interest and tax, which can be calculated from the main business income, deducting expenses and expenditures (excluding financial expenses and income tax). The formula is as follows: EBIT = Operating Income - Operating Costs - Business Taxes and Surcharges - Operating Expenses - Management Expenses - R&D Expenses.

3.1.1. Operating Income

Based on the annual reports of Hengrui Pharma over the past five years, it was calculated that the revenue growth rates of the company from 2019 to 2023 were 33.70%, 19.09%, -6.59%, -17.87% and 7.26% respectively. In 2021 and 2022, due to the impact of the pandemic, the company's revenue showed a negative growth trend, but it returned to a positive growth rate in 2023. Considering the diminishing impact of the pandemic, it is predicted that revenue will first grow at a relatively high rate and then stabilize. Therefore, we use 18%, 16%, 14%, 12%, and 10% to predict the company's revenue growth for the next five years.

3.1.2. Operating Costs

From 2019 to 2023, Hengrui Pharma's operating costs accounted for 12.51%, 12.07%, 14.44%, 16.39% and 15.45% of its operating income respectively. This ratio fluctuated steadily around 14%, so the average value of 14.17% over the past five years can be used to predict operating costs for the next five years.

3.1.3. Business Taxes and Surcharges

From 2019 to 2023, the ratio of business taxes and surcharges to operating income was relatively stable at 0.93%, 0.93%, 0.78%, 0.89%, and 0.96% respectively. Therefore, the average ratio of 0.90% over the past five years can be used to predict the proportion of business taxes and surcharges to operating income for the next five years.

3.1.4. Operating Expenses, Management Expenses, and R&D Expenses

Operating expenses for 2019-2023 accounted for 36.61%, 35.34%, 36.22%, 34.54%, and 33.20% of revenue respectively. Starting in 2021, this ratio began to decline, so we use the average ratio of operating expenses to operating income over the past five years and the trend to predict the proportion of operating expenses to operating income for the next five years as 32%, 31%, 30%, 29%, and 28% respectively.

As for management expenses, the proportion of management expenses to revenue from 2019 to 2023 was relatively stable. The average value of 10.63% over the past five years can be used to predict future management expenses.

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For R&D expenses, considering that Hengrui Pharma capitalized part of its R&D investment in 2021 and that the proportion of R&D expenses will remain at a high level in the future, we exclude data from 2019-2020 and use the average ratio of 22.54% from 2021 to 2023 to predict future R&D expenses.

3.1.5. Capital Expenditure

For ease of calculation, we use the cash paid for the purchase of fixed assets, intangible assets, and other long-term assets from the cash flow statement as capital expenditure. The ratio of capital expenditure to operating income from 2019 to 2023 was 2.41%, 2.00%, 6.43%, 9.36% and 6.50% respectively. Considering the large fluctuation, we take 4.00% as the forecast proportion of future capital expenditure according to the average proportion (4.46%) of capital expenditure in each year from 2019-2023.

3.1.6. Depreciation and Amortization

We use the depreciation of fixed assets and investment real estate, amortization of intangible assets and amortization of long-term deferred expenses as depreciation and amortization.

The proportion of depreciation in the operating income showed an upward trend from 2019 to 2023. Considering the average proportion of 2.25% in the past 5 years, we use 3.00%, 3.15%, 3.30%, 3.45% and 3.60% respectively as the proportion of future predictions.

As for amortization, the amortization expense in 2019-2023 also showed an upward trend. Considering the speed and direction of change, we use 0.5% as the forecast proportion of future amortization in the operating income.

3.1.7. Net Working Capital

Net working capital is calculated as current assets minus current liabilities, and the net working capital is the difference between the working capital of the current year and the working capital of the previous year. Based on the historical data from 2019 to 2023, the proportion of net working capital to operating income was 18.30%, 16.01%, 9.68%, 2.39% and 6.31% respectively. So, considering the high working capital and its large fluctuations in 2019-2020, we take 5.00% as the forecast proportion of the future.

3.2. Discount Rate

The discount rate is the weighted average cost of capital (WACC). The formula is: Weighted Average Cost of Capital = Cost of Debt * (1 - Tax Rate) * Ratio of Debt + Cost of Equity * Ratio of Equity.

3.2.1. Calculation of the Cost of Equity

The formula for the cost of equity is $R_f + \beta\left(R_m - R_f\right)$.

3.2.1.1. Beta Coefficient (β)

β value is a tool to evaluate the systemic risk of assets. It is the main parameter of the capital asset pricing model (CAPM). It reflects the range of a stock changing in the same direction with the market and represents the ability of this stock to further diversify the market portfolio. Stocks with high β values must have excess returns above the market risk premium.

Based on the daily return rate in 2023, this paper selects the comprehensive return rate of Shanghai and Shenzhen markets for all stocks as the market return rate. The comprehensive market annual β

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value of Hengrui Pharma in 2023 is derived from the China Stock Market & Accounting Research Database (CSMAR), and the value is 0.81167.

3.2.1.2. Risk-free Return Rate R_f

Risk-free return rate in the CAPM is the rate of return of a portfolio of stocks or securities without any delinquent risk. It is generally believed that the risk-free return rate is equal to the short-term government bond yield, because the government bonds have low default risk, the credit degree is very high, which can be paid on schedule, and the interest rate is less affected by the market. So, the short-term government bond yield is suitable as the risk-free return rate.

The 3-year short-term government bond yield in 2023 is 2.29%. In this paper, we choose 2.29% as the risk-free return rate.

3.2.1.3. Expected Market Return Rate R_m

According to the study of most scholars, this paper does not calculate R_m. We use market risk premium (Rm-Rf) to take the place of R_m, which is the average GDP growth rate over five years $\left(\frac{6.10\%+2.30\%+8.10\%+3.00\%+5.20\%}{5}\right) = 4.94\%$.

3.2.2. Calculation of the Cost of Debt

The liabilities of enterprises in China are mainly bank loans. According to the loan prime rate (LPR) stipulated by the People's Bank of China, we choose 4.75% as the cost of debt of Hengrui Pharma.

3.2.3. Calculate the Weighted Average Cost of Capital (WACC)

According to the balance sheet of Hengrui Pharma in 2019-2023, the capital structure of each year is calculated by the total owners' equity and total liabilities in the balance sheet and we average it. It is predicted that the capital structure will not change much in the future. Therefore, the cost of debt is 9.17% and the cost of equity is 90.83%.

Combined with the tax rate of about 15%, the weighted average cost of capital is 6.09%. The specific formula is:

$$\begin{aligned} WACC &= 4.75\% \times (1 - 15\%) \times 9.17\% + (2.29\% + 0.81167 \times 4.94\%) \times 90.83\% \\ &= 6.09\% \end{aligned}$$

3.3. Estimate the Value of the Hengrui Pharma

3.3.1. Calculate the Explicit Prediction Stage

Combined with the above forecast, the free cash flow of Hengrui Pharma from 2024 to 2028 is shown in Table 1. In Table 1, the values are in units of a ten thousand yuan.

Table 1: The calculation of forecast FCFF of Hengrui Pharma

Year	**2024**	**2025**	**2026**	**2027**	**2028**
Operating Income	**2,692,734.59**	**3,123,572.13**	**3,560,872.23**	**3,988,176.90**	**4,386,994.58**
Less: Operating Costs	381,628.02	442,688.50	504,664.89	565,224.67	621,747.14
Less: Business Taxes and Surcharges	24,181.64	28,050.70	31,977.80	35,815.14	39,396.65
Operating Profit	**2,286,924.94**	**2,652,832.93**	**3,024,229.54**	**3,387,137.09**	**3,725,850.79**
Less: Operating Expenses	861,675.07	968,307.36	1,068,261.67	1,156,571.30	1,228,358.48
Less: Management Expenses	286,262.83	332,064.88	378,553.96	423,980.44	466,378.48

Table 1: (continued).

Less: R&D Expenses	606,935.17	704,044.80	802,611.07	898,924.40	988,816.84
EBIT	**532,051.87**	**648,415.89**	**774,802.84**	**907,660.95**	**1,042,296.99**
Less: the EBIT income tax (Tax rate: 15%)	79,807.78	97,262.38	116,220.43	136,149.14	156,344.55
NOPLAT	**452,244.09**	**551,153.51**	**658,582.41**	**771,511.80**	**885,952.44**
Add: Depreciation and Amortization	94,245.71	114,010.38	135,313.14	157,532.99	179,866.78
Cash Flow from Operations	**546,489.80**	**665,163.89**	**793,895.56**	**929,044.79**	**1,065,819.22**
Less: Net Working Capital	134,636.73	156,178.61	178,043.61	199,408.84	219,349.73
Less: Capital Expenditure	107,709.38	124,942.89	142,434.89	159,527.08	175,479.78
Free Cash Flow for Firm	**304,143.69**	**384,042.40**	**473,417.06**	**570,108.87**	**670,989.70**
WACC(6.09%)	**0.94**	**0.89**	**0.84**	**0.79**	**0.74**
Discount Value	**286,678.62**	**341,202.48**	**396,454.55**	**450,011.70**	**499,227.34**

According to the table, it is clearly predicted that the enterprise value during the period is 19735746800 yuan. The specific formula is:

$$\sum_{t=1}^{5} \frac{FCF_t}{(1+WACC)^t} = 19{,}735{,}746{,}800$$

3.3.2. Calculate the Permanent Sustained Growth Stage

According to the annual growth rate of national GDP, the development status of Henrui Pharma itself and the future development prospects of the pharmaceutical industry, it is assumed that the company will increase by 4% in the permanent sustained growth stage after 2028. Therefore, it is calculated that the enterprise value in this stage is 248156862300 yuan. The specific formula is:

$$\begin{aligned}\frac{FCF_6}{WACC-g} \times \frac{1}{(1+WACC)^5} &= \frac{FCF_5 \times (1+g)}{WACC-g} \times \frac{1}{(1+WACC)^5} \\ &= \frac{670{,}989.70 \times (1+4\%)}{6.09\% - 4\%} \times \frac{1}{(1+6.09\%)^5} \\ &= 248{,}156{,}862{,}300\end{aligned}$$

3.3.3. Calculation of Enterprise Value

According to the teo-stage DCF model, the value of Henrui Pharma is finally calculated as 267892609082.51 yuan. In the Oriental wealth network, we found that until December 31, 2023, the total number of share capital of Hengrui Pharma was 63779002300 shares. So, the stock valuation of Hengrui Pharma is 41.99 yuan per share. On December 31, 2023, the actual closing price was 45.23 yuan per share. Therefore, the error rate between the stock value calculated by the DCF model and the actual closing price is 7.15%. It is generally believed that the estimated deviation within 10% is an acceptable range, so the evaluation results have reference value.

4. Conclusion

Based on a series of reasonable assumptions, this paper evaluates the stock value of Hengrui Pharma and finds that the actual intrinsic value is slightly lower than the market stock price, indicating that the value of Hengrui Pharma is overestimated in the market. One of the reason is that the development of Henrui Pharma had a great impact during the epidemic period, and the company was in the painful period that centralized procurement of the company had many problem during 2018-2022. Moreover, the company's internal personnel changes had an negative influence on the company, which led to temporary fluctuations in performance and further affected the valuation.

However, starting in 2023, the impact of generic drug collection has been gradually resolved. After the 20th National Congress of the Communist Party of China, the pharmaceutical industry is ushering in a new period of embracing new quality productive forces. Under the influence of favorable policies, the stock prices of many pharmaceutical industry companies, including Hengrui Pharma, have risen. Therefore, considering that Hengrui Pharma is a leading innovative drug enterprise in China and the performance gradually recovers after the epidemic, we believe that a certain valuation premium should be given, and investors can consider to buy the stock.

We suggest that Hengrui Pharma needs to pay more attention on the investment of innovative drug in order to ensure the clinical confirmation of the safety and efficacy of these drugs. Expanding the international path to better serve the global pharmaceutical market is also important. The company should accelerate the transformation path from generic drugs to innovative drugs and further improve the core technology.

This paper has some shortcomings. Only 5 years of data were selected as a sample. The sample data selected is limited. At the same time, the calculation of the parameters is highly subjective, which will lead to the errors in the DCF model, and then affect the predicted stock valuation.

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