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A Valuation Model for the Development of Sinovac Biological Company under COVID-19 Shock

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Abstract: This paper provides an in-depth study of the impact of the COVID-19 pandemic on the global economy and the pharmaceutical and medicine industry, focusing on the Chinese company Biologicals. The financial situation of Sinovac Biologicals before and after the pandemic is analyzed in depth by building a valuation model with data from two different time periods. Before the COVID-19, the company faced cash flow problems and a relatively low market capitalization. This is mainly because at that time, the company may not have been involved in areas related to vaccine production, and the market capitalization was constrained by market demand and industry competition. However, with the outbreak, the company became actively involved in the development and production of the COVID-19 vaccine, leading to a significant improvement in its free cash flow and a rise in its market capitalization. Although the model results emphasize this positive trend, this papermust keep in mind the model's uncertainty and risk factors. Future economic and market conditions are fraught with uncertainty, and Sinovac Biologics may also be exposed to other risks, such as volatility in the vaccine market, policy changes and increased competition. Therefore, a combination of these factors is critical to accurately assessing the company's valuation and prospects.

Keywords: COVID-19, Sinovac Biological Company, DCF Valuation Model, Free Cash Flow

1. Introduction

The COVID-19 pandemic has had a profound impact on the global economy [1]. It all started on December 31, 2019, when 27 cases of a new type of pneumonia of unknown origin were detected for the first time in Wuhan, China [2]. The emergence of COVID-19 had a major impact on people's daily lives. On January 15, 2020, the Chinese Center for Disease Control and Prevention (CDC) initiated a Level 1 emergency response [3]. Over the next three years, China implemented extensive and long-term prevention and control measures to address the COVID-19. It was not until January 8, 2023, with the approval of the State Council, that the National Health Commission of the People's Republic of China (NHSC) issued a regulation lifting the preventive and control measures for Category A infectious diseases caused by novel coronavirus infections, effectively removing them from the scope of the State Border Health Quarantine Law of the People's Republic of China [4]. Additionally, on May 5, 2023, the World Health Organization declared in an article that the COVID-19 pandemic is now a recognized, ongoing health problem and no longer constitutes an international

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emergency public health concern as it did on January 30, 2020, when the highest level of alert was sounded [5]. The article also notes that while countries have reported nearly 7 million COVID-19-related deaths to WHO, the actual number of deaths is likely to be much higher, at least 20 million. The outbreak has had a huge economic impact on a wide range of industries in China and globally [6]. The healthcare sector has been directly affected, but other sectors such as logistics, trade, aviation and tourism have also been significantly impacted. However, despite the economic challenges posed by COVID-19, it also presents opportunities for these industries [7]. The economic impact of COVID-19 on pharmaceutical companies is therefore complex and varied, depending on their specific areas of operation.

The impact of COVID-19 touches all aspects of the pharmaceutical industry, including production, supply chain, sales, research and development, and investment [8]. In order to provide readers with a clearer understanding of the challenges and opportunities posed by pandemics, this paper focuses on pharmaceutical companies involved in the production of COVID-19 vaccines. After several rounds of data screening and extensive analysis, the authors chose Sinovac Biotechnology Company as the only data analyzed. Taking the time when the pandemic started as a reference, a valuation model was established to study the company's economic data before and after the COVID-19 pandemic.

Sinovac Biotech was selected as a case study because the company experienced a particular set of challenges and opportunities during the COVID-19 pandemic. At the beginning of the COVID-19, Sinovac Biologicals was hit as hard as any other company due to the global health crisis caused by the COVID-19. However, what made Sinovac Biotech stand out was that it not only found business opportunities in the crisis, but also unprecedented challenges through the production of the COVID-19 vaccine.

Sinovac Biotech plays a key role as an important manufacturer of the COVID-19 vaccine. They had to meet not only the domestic market demand but also the global market demand, which posed a huge challenge to their production capacity. Production of the vaccine has scaled up dramatically to meet global demand during a pandemic, which may require additional investment in equipment and human resources.

Against this backdrop, this paper will analyze the performance of Sinovac Biologicals in detail, examining how they responded to the surge in production demand during the pandemic and how they balanced the challenges and opportunities. This case will not only provide insight into the pharmaceutical industry's situation during the COVID-19 pandemic, but also provide useful insights into how pharmaceutical companies can take effective measures in response to a global health crisis.

2. Data

2.1. Data Selection

Given that this research focuses on valuation modeling of the impact of COVID-19 on the development of the pharmaceutical industry, the author carefully chose the vaccine sector, which is closely related to the current global COVID-19, as the focus of the research, and specifically selected Sinovac Biotech as the only data analyzed from a number of pharmaceutical companies that provide COVID-19 vaccines globally. There are multiple well-thought-out reasons behind this choice.

First, Sinovac Biotech, as a publicly traded company, provided the high-quality financial data author needed to provide a solid data base for the analysis. These data will allow the author to conduct an accurate and comprehensive financial assessment to better understand the company's operating conditions and financial performance.

Secondly, considering that Sinovac Bio is headquartered in China, this makes its financial position significantly affected by the national economy of China. As one of the world's largest countries in terms of population, China has a significant influence on the global pharmaceutical market. Therefore,

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choosing Sinovac Biologicals as the subject of the project study helps to gain insights into the dynamics of China's domestic pharmaceutical market and to explore the performance of international pharmaceutical companies in the Chinese market.

Finally, considering the fact that the COVID-19 was first detected in China and received rapid attention from the Chinese government, the financial data of Sinovac Biologicals, a company involved in the development and production of the COVID-19 vaccine, may be significantly characterized in this context. Therefore, by analyzing Sinovac Bio's financials in depth, this paper can expect to gain deeper insights to understand the company's performance and future growth potential during the COVID-19 outbreak.

Overall, the selection of Sinovac Biotech as a research subject is based on a number of considerations and aims to provide a rich and in-depth data base for the pharmaceutical industry development modeling study, in order to better understand the company's business and its positioning in the global pharmaceutical market.

2.2. Data Sources

In this paper, this paper has successfully obtained the annual reports of Sinovac Biotech, Inc. for the period of 2015 to 2022 by accessing the website of the United States Securities and Exchange Commission (U.S. Securities and Exchange Commission) [9]. This rich source of data was carefully organized and categorized to provide a solid foundation for the research.

This research plan to use a discounted cash flow valuation model to project the future valuation of Cochrane Biotech. This model will take into account various key factors, such as the company's financial indicators, industry trends, market outlook, and macroeconomic conditions. By analyzing these data and factors in depth, the research will be able to assess the future value of Sinovac Biologicals more comprehensively and professionally.

2.3. Establishment of Data Valuation Model

In order to gain a more professional and clearer understanding of the impact of the COVID-19 on Sinovac Biologicals, the research will use two different data valuation models for a more comprehensive analysis. These two models will help us to explore the situation before and after the outbreak in depth and make a comparative analysis. Specifically, the author will construct the following two underlying valuation models:

First, this study will build a pre-epidemic model covering the time period from 2015 to 2019 using a discounted cash flow valuation model. This will allow the author to assess the future valuation of Sinovac Biologicals in the absence of the impact of the COVID-19 epidemic.

Second, this study will construct a model for after the start of the outbreak, covering the time period from 2018 to 2022, again using a discounted cash flow organization model. This model will help assess the economic impact of the COVID-19 epidemic on Sinovac Biologicals, as well as the future valuation of the existing company.

Through the creation of these two models, the research will be able to calculate the valuation of Sinovac Biologicals for the next five years, when there is no impact of the outbreak and under the impact of the outbreak, respectively. This will help allow the research to determine if the impact of the COVID-19 epidemic on the company will be positive or negative.

3. Methodology

3.1. Calculation

This paper adopts DCF valuation model, which is calculated by the following detailed formula:

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$$DCF=\frac{FCFF_1}{(1+r)}+\frac{FCFF_2}{(1+r)^2}+\frac{FCFF_3}{(1+r)^3}+\frac{FCFF_4}{(1+r)^4}+\frac{FCFF_5}{(1+r)^5}+\frac{FCFF_5}{(1+r)^5}\times\frac{(1+g)}{(r-g)} \quad (1)$$

In this model, r represents the discount rate, g represents the perpetual growth rate, and FCFF represents the free cash flow. These three parameters play a crucial role in DCF valuation, the discount rate is used to consider the time value of future cash flows, and the perpetual growth rate is used to estimate the long-term growth potential of the firm. And as the core of the DCF model free cash flow is used for financial forecasting of the enterprise, the formula for free cash flow (FCFF) is as follows:

Free Cash Flow (FCFF) = Net Income + Interest * (1 - Tax Rate) + Depreciation and Amortization - Capital Expenditures - Working Capital (2)

Through this refined valuation methodology, this paper is able to more accurately assess the value of a business, based on financial projections and capital market conditions, providing strong data support for decision makers. This specialized approach helps to reduce investment risks and increase the credibility of financial decisions, enabling companies to better plan their future strategic development.

3.2. Process

First of all, this paper will carefully organize the company's financial statements and present the data clearly in two Excel sheets, covering the years 2015 to 2019 and 2018 to 2022 respectively. In this process, this paper will extract data related to net income, interest, tax rate, depreciation and amortization, capital expenditures, and working capital from the annual reports of Cochrane Biologicals, Inc. in order to create a complete bottom line table. Next, this paper will apply the financial modeling formulas this paper learned earlier to calculate the free cash flow (FCFF) of Sinovac Bio for the period from 2015 to 2022. This calculation will provide us with key data to understand the company's financial position.

This paper will then begin to construct a valuation model. By deeply analyzing the previously obtained data, this paper will estimate the company's revenue growth rate, tax rate, depreciation and amortization rate, capital expenditure rate, and working capital rate for the next five years. This paper will then apply these estimates, in conjunction with the valuation model, to calculate the actual value of the company over the next five years. Finally, this paper will calculate the future free cash flow for two separate scenarios, one forecast covering the years 2020 to 2024 in the absence of the outbreak, and the other forecast covering the years 2023 to 2027 after taking into account the impact of the outbreak. This will provide with a valuation of two different scenarios of the company's future development, which will help to more fully assess the potential risks and opportunities posed by the outbreak to Sinovac Biologicals.

4. Analysis of Results

For forecasting future data, growth rate-based assessment is a common approach [10]. In this approach, this paper use historical data and some key assumptions to make predictions in order to inform future decisions.

First, this paper will focus on the revenue growth rate (Revenue Growth). This paper begin by analyzing revenue data from previous years to identify trends in revenue growth. Then, this paper will make a bold estimate that directly predicts the revenue growth rate for the next five years. This estimate relies on multiple factors, including market trends, industry competition, company strategy,

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and more. By applying this growth rate, this paper are able to calculate projected revenue for the next five years.

Next, this paper proceeded to estimate Earnings Before Interest, Taxes, Depreciation, and Amortization (EBITDA). For this purpose, this paper first added up the EBITDA margin data for the past five years and calculated its average. Then, by applying this average to the projected revenue for the next five years, this paper were able to derive EBITDA for the next five years. In addition, since EBITDA margin equals the ratio of EBITDA to revenue, this paper were able to derive an estimated EBITDA value. Similarly, this paper use the same methodology to calculate Depreciation & Amortization Rate (D&A Rate) and Tax Rate (Tax Rate) and arrive at a specific valuation for the next five years. In addition, Capital Expenditure and Rate of Non-Cash Working Capital are also included, and these factors are affected by a similar estimation methodology. Subsequently, this paper can utilize the data from these estimates to calculate free cash flow for the next five years using the Free Cash Flow to Firm Value (FCFF) formula. Finally, by applying a discounted cash flow (DCF) valuation model and selecting an appropriate discount rate and perpetual growth rate, this paper can provide insight into the future valuation of the business. This approach provides a systematic way to assess the future performance of a business, and although the accuracy of the estimates relies on reasonable assumptions and data availability, it provides decision makers with valuable information to support strategic planning and investment decisions.

Below are two separate tables of projections, Table 1 shows the FCFF valuation table without the outbreak and Table 2 shows the FCFF valuation table now, after the outbreak. Based on the data in Table 1, this paper can observe that the free cash flow valuation is negative from 2020 to 2024. This reflects that the company's operations are not generating sufficient cash flow to meet its capital expenditure and other financial needs. This situation requires the Company to take a number of steps to improve its free cash flow, including but not limited to increasing revenue, reducing costs, and optimizing capital expenditures. Continued negative free cash flow is a worrying sign, as it could lead to the company facing a serious problem of underfunding in the long run. In particular, after considering a perpetual growth rate of 1.5% and a discount rate of 9%, the company's pre-epidemic market capitalization was estimated to be -504,955.23 based on the DCF valuation formula. This valuation is much lower than the current market price, which raises concerns about the company's valuation and long-term health. The results of this analysis suggest that the company's financial position requires urgent attention and improvement. The company may need to take a number of steps to improve its cash flow, including increasing revenue streams, reducing expenses through effective cost control, and optimizing capital expenditures to ensure its sustainable growth in the future. In addition, the company should review its long-term strategy to ensure that it can maintain good financial health in the future and avoid the risk of funding shortfalls and market capitalization declines. This analysis not only provides insight into the current state of the company, but also provides a useful reference for future strategic planning.

Table 2 presents a series of helpful trends that provide important insights into the financial health of the company. Despite low free cash flow at the time of the outbreak in early 2020, the company has experienced significant growth in free cash flow since 2021. Particularly noteworthy is the significant upward trend in the company's free cash flow from 2023 through 2027, which suggests that the company's financial health improved significantly during this timeframe. This positive trend can be attributed to an increase in pre-tax profits as well as effective management of capital expenditures and net working capital. The company now has the opportunity to fully utilize these positive free cash flows to support business growth, pay down debt, or give back to shareholders. However, these cash flows need to be carefully managed to ensure that funding requirements for various needs and investments are met in the future.

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Table 1: 2015-2024 pre-epidemic FCFF valuation.

thousands of U.S. dollars	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Revenue	174,346	72,431	174,346	229,650	246,053	196,842	458,643	687,964	914,992	988,192
Revenue Growth		-58.46%	140.71%	31.72%	7.14%	-20.00%	133.00%	50.00%	33.00%	8.00%
Income Tax	-2,985	-2,664	-8,339	-10,472	-5,605	2,141	4,987	7,480	9,949	10,744
Tax Rate	63.42%	60.79%	-29.80%	-39.39%	-9.20%	9.16%	9.16%	9.16%	9.16%	9.16%
EBIT	-4,707	-4,382	27,980	26,585	60,956	23,361	54,441	81,661	108,609	117,298
Depreciation & Amortization	6,519	5,310	4,881	5,136	4,817	5,852	13,622	20,433	27,175	29,349
Rate of DA	3.74%	7.33%	2.80%	2.24%	1.96%	2.97%	2.97%	2.97%	2.97%	2.97%
EBITDA	1,812	928	32,861	31,721	65,773	29,212	68,063	102,094	135,785	146,648
EBITDA Margin	1.04%	1.28%	18.85%	13.81%	26.73%	14.84%	14.84%	14.84%	14.84%	14.84%
Capital Expenditure	5,300	12,700	11,900	5,600	10,600	10,118	23,574	35,361	47,031	50,793
Capex Margin	3.04%	17.53%	6.83%	2.44%	4.31%	5.14%	5.14%	5.14%	5.14%	5.14%
Change in NWC	4,446	6,040	-46,862	-114,625	-36,438	-31775	-74025	-111037	-147680	-159494
Rate of NWC	2.55%	8.34%	-26.88%	-49.91%	-14.81%	-16.14%	-16.14%	-16.14%	-16.14%	-16.14%
FCFF	10,462	2,242	-12,681	-72,896	29,157	-8,969	-20,902	-31,353	-41,699	-45,035

Table 2: 2018-2027 post-epidemic FCFF valuation.

Thousands of U.S. dollars	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Revenue	229,650	246,053	510,624	19,374,904	1,492,761	1,597,254	2,076,430	3,737,575	9,343,937	10,278,331
Revenue Growth		7.14%	107.53%	3694.36%	-92.30%	7.00%	30.00%	80.00%	150.00%	10.00%
Income Tax	-10,472	-5,605	-31,438	-3,104,130	62,893	-46,687	-60,717	-109,290	-273,226	-300,549
Tax Rate	-39.39%	-9.20%	-20.39%	-27.10%	41.94%	-10.83%	-10.83%	-10.83%	-10.83%	-10.83%
EBIT	26,585	60,956	154,218	11,454,513	149,951	431,259	560,636	1,009,145	2,522,863	2,775,149
Depreciation& Amortization	5,136	4,817	155,172	11,653,977	147,804	335,423	436,050	784,891	1,962,227	2,158,450
Rate of DA	2.24%	1.96%	30.39%	60.15%	9.90%	21.00%	21.00%	21.00%	21.00%	21.00%
EBIDTA	31,721	65,773	309,390	23,108,490	297,755	766,682	996,687	1,794,036	4,485,090	4,933,599
EBIDTA Margin	13.81%	26.73%	60.59%	119.27%	19.95%	48.00%	48.00%	48.00%	48.00%	48.00%
Capital Expenditure	5,600	10,600	127,700	751,000	439,100	97,498.76	126,662	227,992	569,980	626,978
Capex Margin	2.44%	4.31%	25.01%	3.88%	29.42%	6.10%	6.10%	6.10%	6.10%	6.10%
Change in NWC	-114,625	-36,438	-618,275	-11,621,580	1,467,502	-471,123	-612,547	-1,102,585	-2,756,462	-3,032,108
Rate of NWC	-49.91%	-14.81%	-121.08%	-59.98%	98.31%	-29.50%	-29.50%	-29.50%	-29.50%	-29.50%
FCFF	-72,896	29,157	-249,975	25,494,017	1,411,069	244,747	318,194	572,750	1,431,874	1,575,062

Considering further, when keeping the variables in equilibrium, using a perpetual growth rate of 1.5% and a discount rate of 9%, the company's future market capitalization post COVID-19 epidemic is expected to be 16,826,513.18 based on the DCF valuation formula. This valuation is much higher than the current market price, which underscores the company's latent potential to increase in value. It also emphasizes the positive impact of the financial improvement experienced by the company post the outbreak on its future market capitalization. This valuation gap provides investors with a favorable investment opportunity as well as a capital base for the company to further develop and grow. However, it should be noted that this valuation is dependent on a number of factors, including assumed sustainability and market factors, and therefore requires careful risk assessment and monitoring to ensure the sustainability of investment decisions.

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5. Conclusion

The impact of the outbreak on Cochrane Biologicals is undoubtedly complex and multi-faceted. Based on my model predictions, the COVID-19 has given Sinovac Biologicals a huge opportunity that cannot be ignored. This opportunity is not only reflected in the company's profitability, but also in its prospects for future growth. However, this paper need to analyze all this wisely and not just see the benefits. First, let's talk about the DCF model. the DCF model is a methodology used to value a company that relies on several factors, including expected future cash flows, the discount rate, and the assumptions used in the model. During the outbreak, Sinovac Biologicals may have received additional cash flow from the production of vaccines, which may have positively impacted the valuation of the DCF model. However, this is not a long-term phenomenon and therefore future cash flows need to be considered with caution. In addition, DCF models are very sensitive to future assumptions. There is a lot of uncertainty in the process. It must understand that the future is always fraught with risk. Investors need to take into account risk factors such as market changes, industry competition and macroeconomic factors and factor these into the valuation. These risk factors may adversely affect a company's future cash flows, which in turn affects the valuation of the DCF model. It is worth pointing out that this paper uses a base valuation model that may not take all factors into account. There may be unforeseen events in the future which may have a significant impact on the company's business and data. This is inevitable as it cannot predict everything in the future.

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