Portfolio Construction based on Equal Weights: Evidence from U.S. Pharmaceutical Sector

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Abstract. Within the context of the renewed global emphasis on the pharmaceutical sector as a result of the new crown epidemic, this article investigates how to develop a portfolio within the pharmaceutical industry. This focus comes as a direct result of the new crown outbreak. The primary source of the data is investing, and the time period covered is from December 31, 2016, to July 31, 2022. This study is organized around four main components: research on different market sectors, stock selection, portfolio design, and portfolio evaluation. The annualized return of the portfolio was 17.55%, which was higher than the annualized return of the S&P 500, which was 12.43%. This pharmaceutical sector portfolio's Jensen's Alpha, Treynor Ratio, and Sharpe Ratio all suggest that the portfolio has been effective in outperforming the market. This would seem to indicate that the pharmaceutical industry has historically been one of the least successful industries. The findings of this study have important repercussions for people who invest in stocks of pharmaceutical companies.

Keywords: COVID-19; Portfolio; Pharmaceutical Sector.

1. Introduction

The creation of three portfolios with equal weights is the goal of this study. Against the backdrop of the COVID-19 outbreak, market anxiety has sharply grown. However, the pharmaceutical industry outperformed the other businesses on the American stock market. Whatever pandemic outbreak or not, the pharmaceutical industry was regarded as one of the industries that have a long life-cycle in the economy. Humans always live with all kinds of viruses and diseases, and viruses evolve by themselves. This means that pharmaceutical science will always be developed and upgraded in the whole future. Hence, it is reasonable that the pharmaceutical area is worth long-term investment. This study will select stocks from the pharmaceutical industry for constructing portfolios and the experimental data is from December 31, 2016 to July 31, 2022. This study will answer the question of how to select the companies. There are four parts in this study. Studies background and industry information will be shared in the first part. In the second part, it introduces the criteria of security selection and which stocks are selected. The third part mainly discusses how to build the three portfolios under equal weights, unequal weight and mean variance, and analyzes their performance. Finally, it will discuss the findings and make conclusions.

Global economic expansion has been impacted by the COVID-19 epidemic. The outbreak has significantly interrupted socio-economic activity around the world as a result of the suspension or cancellation of all kinds of events brought on by widespread supply scarcity fears. 97% of students worldwide have been impacted by the closure of schools and institutions across more than 160 nations and territories. Many nations have implemented severe control measures such as hotel closures, travel bans, aviation restrictions. The population's income and the state of the economy will be impacted by business closures. Concerns about the economy and human lives have increased as a result of the outbreak. The market for consumer goods will be considerably affected. By limiting aircraft cancellations and limiting foot traffic, airlines' profits, which are mostly derived from the price of airline tickets, are directly lowered. For certain financially indebted businesses, especially those that are heavily leveraged, this is a nightmare. The risk of bankruptcy was greatly raised by the lack of income and the requirement to pay back debts and rent. Some businesses, like those in the medical industry that produce masks and respirators, which were in extremely limited stock, profited from the outbreak. The returns on biotechnology stocks in Taiwan changed in a good way as a result of the

SARS crisis. According to Chen et al. there was a significant rise in demand for medical supplies and care during Taiwan's SARS outbreak [1]. Additionally, as these goods constituted the bulk of the biotechnology sector's output, their share prices had to increase. In the Chinese pharmaceutical sector, Zhao studied into the connection between SARS disclosure and listed businesses' market sensitivity. When people pay less attention on SARS news, they observed that pharmaceutical stock prices remained consistent [2]. When COVID-19 happened in China, medical companies and companies in technology areas surpassed other stock market sectors, according to study by Al-Awadhi et al [1]. Global conferences and activities were postponed or canceled as the virus spread. The need for services to support work from home increased during that time, which was good for the telecoms industry. The technology sector may experience problems including electronic transport delays and rules on mobile control. There will be some technology enterprises that must shut down. In addition to resulting in significant casualties, COVID-19 is anticipated to change on biometrics businesses, related innovation, and the whole market [3]. However, some scientists think that COVID-19 might encourage development in some technological fields. The use of telemedicine surged during the COVID-19 global epidemic, and it became clear how digital health could enhance mental health access and quality [4]. Digital innovations like the Internet of Things, AI, big data analytics, and drones (UAVs) are also assisting in addressing the significant global concerns brought on by COVID-19 [5, 6]. Such positive information about the biopharmaceutical and healthcare industries may encourage investors, which is expected to have an impact on asset values.

Even without an epidemic outbreak, the pharmaceutical industry has long-term growth value. With the development of economies around the world and the improvement of human living standards, the demand for both medical and healthcare drugs has been relatively stable, which has led to the pharmaceutical industry being known as a "defensive industry" in the investment community. In addition, the increasing national sub-health and an aging population have led to increased government and personal investment in the pharmaceutical industry, which will likely lead to a large portion of future healthcare spending. Therefore, I am personally very bullish on the long-term growth value of the pharmaceutical industry. This research will then focus on the individual stocks in the pharmaceutical sector forming the portfolio and how they will perform will be discussed.

2. Methodology and Data

Individual stock selection is very important for a portfolio. The operating circumstances of a firm issuing shares are a long-term, significant element in determining its share price in the stock market. Analysis and examination of the financial statistics statements, also known as the basic analysis, are particularly necessary since they reflect the working circumstances of listed corporations. Financial analysis of stock investment means that investors analyze and interpret the financial statements of a joint stock company to understand the financial situation and operating effects of the company, and then understand the favorable and unfavorable effects of the changes in the financial reports on the price of the stock, and ultimately make an accurate judgment on whether it is beneficial and safe to invest in a particular stock. Therefore, financial analysis is generally considered to be an important part of fundamental analysis. There are many methods of financial analysis, but in this case, we have used liquidity (current ratio), profitability (Net Profit margin), leverage (Total Debt to Equity), and growth (5-year sales growth) as the criteria for stock selection, as discussed below.

2.1 Methodology

2.1.1 Liquidity ratio

Liquidity ratio (short-term solvency). It assesses the company's capacity to settle its immediate debts or short-term solvency. The current ratio and the current ratio are the components of them. The current ratio, known as the working capital ratio, is the correlation between assets and liabilities at the moment [7]. Current liabilities are those that can be repaid within a short period, whereas current assets are those that are in the form of cash or cash equivalents or assets that may be turned into cash

or cash equivalents within a short period (for example, within one year) [7]. To assess a company's ability to promptly pay its short-term creditors, utilize the current ratio. It indicates how frequently cash can be generated from current assets to settle current liabilities. Current liabilities should typically be twice as high as current assets. A low ratio shows that a company cannot cover its current liabilities and working capital deficit. A high ratio denotes inefficient capital allocation. A company should have an appropriate current ratio. A current ratio of 2:1 is seen as satisfactory, while there is no hard and fast rule in this regard [7].

2.1.2 Net profit margin

The ratio of a company's profit margin to the total number of opinions received is known as the net profit margin. A firm's net profit margin is frequently used as a gauge of its performance since a higher net profit margin shows that the company has been successful in increasing both its revenue and the effectiveness of its burde. Due to the correlation between NPM value and management firm quality, this performance draws in both investors and the general public to exchange shares with the company. This is consistent with the findings of Kusmayadi, et al. and Dita & Murtaqi studies that examined the impact of net profit margin (NPM) on stock prices [8, 9]. However, as there are currently no set standards for choosing stocks based on NPM, I favor businesses with consistent profitability and opt for those with an average NPM of more than 10% over the previous five years.

2.1.3 Total debt to equity ratio

The debt-to-equity ratio is calculated to assess the viability. This ratio expresses the relationship between debt (external equity) and equity (internal equity). Bonds and other long-term loans from financial institutions are examples of long-term loans, or debt [7]. Preference share capital, equity share capital, reserves for fewer losses, and artificial assets like preliminary charges are all examples of shareholder cash referred to as equity. A riskier financial position is indicated by higher ratios, whilst a safer financial position is indicated by lower ratios. A reasonable debt-to-equity ratio is 2:1, which allows debt to double the amount of equity [7].

2.1.4 Sales growth

Higher sales growth indicates that the business is doing well, which supports a rise in profits. Both Missy et al. and Odalo et al. demonstrated in their studies that sales growth positively affects profitability [3, 10]. The findings demonstrate that increased sales growth boosts the company's profitability in a good direction. The company is committed to growing the company and marketing its goods, which affects profitability. But since there isn't a set standard for choosing stocks based on sales growth, my personal preference is for sales growth of at least 5% over five years. Although 5% annual sales revenue growth is not a high rate, it does show that the company is performing more consistently in the near term.

2.2 Data

Based on the stock selection criteria for this study, we used Investing.com's Screener feature for stock screening, as shown in Table 1.

Table 1. Stock selection criteria

Ratios	Criteria
Current ratio	>1
Net profit margin	>10%
Total debt to equity	<200%
5 years sales growth	>5%

Next, 11 stocks in the pharmaceutical sector were selected, as shown in Figure 2 below.

Table 2. Stock screener results in investing

Name	Symbol	Last	Change.%
Eisai Co ADR	ESALY	46.45	-0.24%
J&J	JNJ	166.81	0.43%
Eli Lilly	LLY	311.73	-0.7%
Jazz Pharma	JAZZ	161.16	0.56%
Trulleve Cannabls	TCNNF	13.198	0.9%
Innoviva	INVA	14.39	-1.17%
Corcept	CORT	27.38	-2.46%
Antares	ATRS	5.59	0%
Aurora Cannabis	ACB	1.775	-6.08%
BioDelivery Sciences	BDSI	5.59	0%
CSPC Pharma	CHJTF	1.12	0%

Our research timeframe is from December 31, 2016, to July 31, 2022, so four stocks that were listed after 2017 are not eligible, including Eisai Co ADR, Trullieve Cannibals, Antares, and BioDelivery Sciences, were deducted from the list of Screener. The remaining seven stocks in the pharmaceutical sector make up the portfolio, as shown in Table 2 below.

Table 3. Portfolio components

Name	Symbol
J&J	JNJ
Eli Lilly	LILY
Jazz Pharma	JAZZ
Innoviva	INVITE
Concept	CORT
Aurora Cannabis	ACB
CSPC Pharma	CHJTF

3. Portfolio Construction

We will use an equal weighting approach to construct the portfolio. An equally weighted portfolio strategy maintains a capital weight of 1/n for each asset (assuming there are n assets). An equally weighted portfolio ensures sufficient diversification, thereby reducing risk. The equal-weighted investment strategy avoids the over-representation of some stocks in the index. The equal-weighted strategy is the most diversified type of investment strategy, with each constituent stock being bought evenly.

3.1 Portfolio Design One

First, on December 31, 2016, we assume we have $7 million in cash and then invest an average of $1 million in each stock. We will hold these stocks until July 31, 2022. During this period, we will not make any purchases or sales of the stocks. Next, we divide $1 million by the share price of the constituent stocks to arrive at the number of holdings in each stock, as we will not be trading in the

stocks and the number of holdings in the constituent stocks will remain constant over time. In Step 3, we would multiply each month's share price by the number of holdings of individual stocks to arrive at the Market value of shares held for each stock, and then we would add up the market value of the individual constituent stocks to arrive at the market value of the portfolio. Finally, we calculate the monthly return and cumulative monthly return based on the different market values of the portfolio for each period.

The monthly and cumulative monthly returns for the portfolio are shown in Figures 3 and 4 below. The portfolio's monthly returns were consistently positive through 2018, however, after 2019 the portfolio's monthly returns were more volatile. As shown in Figure 4, the portfolio's returns are primarily derived from gains before 2018. After 2018, the portfolio's cumulative returns show greater volatility, and the portfolio's rebound in 2020 is also due to the outbreak of the new crown epidemic and the renewed focus of many investors on the pharmaceutical industry. As of 1st August in 2022, the portfolio had a cumulative return of 81.75%.



Figure 1. Monthly return of portfolio from Dec 31, 2016, to Jul 31, 2022



Figure 2. Cumulative monthly return of portfolio from Dec 31, 2016, to Jul 31, 2022

3.2 Portfolio Design Two

The portfolio model can be used to build our portfolio as well. The risk-free rate in this scenario is the United States 10-Year Bond Yield on August 18, 2022, or 2.824%. Excel will be used to calculate the portfolio using the methodology below.

$$Annual\ return = \frac{P_{t+1}}{P} \quad (1)$$

$$Excess\ return = R_t - \underline{R} \quad (2)$$

$$\sigma^2(Variance) = \frac{\sum (x_i - \underline{x})^2}{n-1} \quad (3)$$

$$Cov(x,y) = \frac{\sum (x_i - \underline{x})(y_i - \underline{y})}{n} \quad (4)$$

$$\beta = \frac{Cov(R_S, R_M)}{Var(R_M)} \quad (5)$$

CAPM model: $Expected\ return = R_F + \beta(R_M - R_F)$ (6)

Variance of Portfolio:

$$\sigma^2{}_P = W^2{}_i\sigma^2{}_i + W^2{}_j\sigma^2{}_j + 2w_iw_j\text{Cov(i,j)}..... W^2{}_{n-1}\sigma^2{}_{n-1} + W^2{}_n\sigma^2{}_n + 2w_{n-1}w_n\text{Cov(n-1,n)}$$

Matrix form: $\sigma^2{}_P = W^T VW$ (7)

The portfolio's equity weightings, individual annual returns and portfolio returns are shown in Table 4. We find that Aurora Cannabis has the highest average annual return (37.89%), Eli Lilly provides the second highest average annual return (29.83%) and J&J has the highest market capitalization and provides the lowest annual return. It was only 8.79%. The portfolio's overall average annual return is 17.55%, which is greater than the S&P 500's (12.43%) estimated yearly return.

Table 4. Annual return of portfolio components under the equal weight

Assets	Symbol	Weight	Annual Return of each security	Annual return under equal weights
J&J	JNJ	14.29%	8.79%	1.26%
Eli Lilly	LLY	14.29%	29.83%	4.26%
Jazz Pharma	JAZZ	14.29%	10.70%	1.53%
Innoviva	INVA	14.29%	10.50%	1.50%
Concept	CORT	14.29%	10.50%	1.50%
Aurora Cannabis	ACB	14.29%	37.89%	5.41%
CSPC Pharma	CHJTF	14.29%	14.63%	2.09%
J&J	Sum	1		17.55%

The standard deviation, variance, and beta performance of the portfolio are shown in Table 4. The variance of this portfolio is 004683 with a standard deviation of 6.84%. This illustrates the portfolio's

volatility of 6.84%, which indicates that in a two-state distribution, the returns are spread over ±6.84% of the mean. The beta for this portfolio is 0.755996, which illustrates the lower volatility of this portfolio compared to the S&P 500. When the S&P 500 increases (decreases) by 1%, the portfolio increases (decreases) by 0.755996%. The portfolio offers a low beta, but higher annualized return than the S&P 500.

Table 5. Variance, standard deviation, and beta of the portfolio

Portfolio variance	0.004683
Portfolio SD	6.84%
Beta	0.755996

3.3 Portfolio Performance

Jensen's alpha for the portfolio, which is greater than zero and is displayed in Table 5, is 7.47%, indicating that the portfolio is outperforming the market through wise asset allocation. A portfolio that generates an excess return of 19.48% per unit of risk taken has a Traynor ratio of 19.48%. A fund's return on the risk it assumes increases as the Sharpe ratio increases. A Sharpe ratio of 2.0 or above is thought to be very valuable, whereas one of more than 1.0 is thought to be acceptable. The Sharpe ratio for the portfolio is 215.19%, which is higher than 2.0. This demonstrates the portfolio's continued value as a purchase. An M-squared (M2) ratio of zero indicates that a portfolio matches the market return, whereas a positive M-squared (M2) ratio indicates that a portfolio outperforms the market. The M-squared (M2) ratio for this portfolio is 13.81%, which indicates that it is outperforming the S&P 500. When combined, this portfolio can generate a respectable return and outperform the benchmark market.

Table 6. Portfolio performance

	Portfolio	S&P500
Return	17.55%	12.43%
SD	6.84%	5.11%
Beta	75.60%	100.00%
Excess return	14.73%	9.60%
Jensen’s Alpha	7.47%	
Treynor Ratio	19.48%	
Sharpe Ratio	215.19%	
M-Squared (M^2) Ratio	13.81%	

4 Conclusions

In this article, we have chosen seven pharmaceutical businesses with New York Stock Exchange listings to act as test subjects for the pandemic. The portfolio met the requirements of a moderate to medium risk investor throughout the observation period with a total return of 81.75%, a beta of 0.75599553, and a volatility of 6.84%.The portfolio's anticipated return exceeded both the standard market's and the risk-free rate.. Jensen's Alpha, Treynor Ratio, Sharpe Ratio, and M-squared Ratio values for the portfolio's performance metrics show that it has the potential to exceed the benchmark market (the S&P 500) and is therefore a worthwhile investment.

Future economic conditions are difficult to predict and this investment product still has some drawbacks. Even though the overall industry has a long life cycle, there are risks in the pharmaceutical industry. Firstly, the pharmaceutical industry has R&D risks, which I am afraid are common to all pharmaceutical companies, and even companies with strong R&D capabilities can fail. Secondly, the pharmaceutical industry has the risk of product quality, which is also a very common risk. Pharmaceutical items must meet extremely rigorous quality standards since they directly interact with the human. However, due to the lengthy production process, quality issues are inevitable.

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