

Portfolio Analysis and Investment Value Based on US Stock Market

Zhiyu Chen*

Fisher College of Business, The Ohio State University, Columbus, OH, US

*Corresponding author: chen.10149@osu.edu

Abstract. An investment portfolio can contain a variety of assets, including cash, stocks, bonds, financial derivatives, precious metals, and cash. You shouldn't invest all of your money in the same thing, similar to the adage "don't put all your eggs in one basket." Put your eggs in a variety of baskets so that even if one breaks, they will remain safe. In this study, five equities—Eli Lilly, Amazon, FedEx, J.P. Morgan Chase Bank, and Pfizer—are constructed using the Markowitz Mean-Variance Model and Effective Frontier. The portfolio is built using data from these five stocks during the previous three years. Given that stocks can be shorted, the portfolio has a Sharpe Ratio of 9.07%, a yield of 2.99%, and a ceiling of negative 1 for each stock. The risk of this best answer, which was determined by solving combinations, is 9.63%. The usual 10-year Treasury bond's average return is 2.12%, which is less than the ideal yield.

Keywords: Sharpe Ratio; Finance; Stock Market.

1. Introduction

A basket of assets, such as stocks, bonds, financial derivatives, precious metals, and cash, can all be included in an investment portfolio [1]. Similar to the proverb "don't put all your eggs in one basket," you shouldn't invest all of your money in the same item. Put your eggs in various baskets so that they will be secure even if one of them breaks [2-3]. Similarly, to this, diversifying risks is the main goal of creating a core portfolio. A single asset may see quite substantial swings, but if you own a portfolio made up of several different asset classes, the variations of the different asset classes will balance each other out and lower the portfolio's total risk.

Strategy diversification is one of the most crucial aspects of any investing portfolio. By reducing the risk associated with any one holding, portfolio diversification shields investors from significant fluctuations in important industries. In order to diversify, traders frequently trade both stocks and bonds [4-6]. However, by including futures and futures options contracts in the investing portfolio during market turbulence, investors can maximize returns. Market participants have the flexibility to reduce or enhance exposure in the event of predictable and unforeseen event-driven volatility by using futures and options on futures.

In order to assist investors in implementing value investment techniques, this article chooses five American-listed companies for portfolio examination.

2. Data

I chose the recent three years' stocks from five different companies.

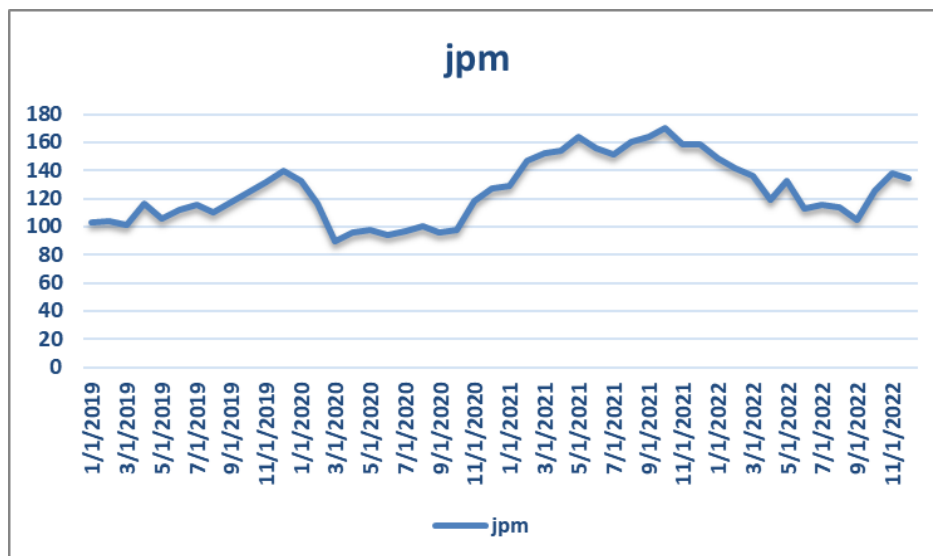


Figure 1. 2019-2022 JPM Stock Price.

The first company is JPM. As we all know JP Morgan Chase & Co (JPM) is one of the oldest financial institutions in the United States. JPM manages more than \$2.6 trillion for its clients, operates in more than 100 global markets, and employs more than 250,000 people. JPM is America's ideal employer and one of the world's most admired companies, ranked by business school students as one of the top 5 most attractive employers in the world. JPM's board of directors now has 11 members [7-8], who are responsible for setting up a board of directors to guide the overall development.

From January 1st, 2019 to December 31st, 2022, JMP stock price changed from \$90.03 to \$169.89, the mean price of the stock was \$126.12, the standard value was 3.295, the standard deviation is 22.596, the open price was \$103.50, and the closed price is \$134.10. Based on the stock price we can see that the Covid-19 effect from November 2019 to March 2020, and until February 2021, the stock price returned back to the original price. The mean return of JPM stock is 0.9% and the standard error is 0.01233.

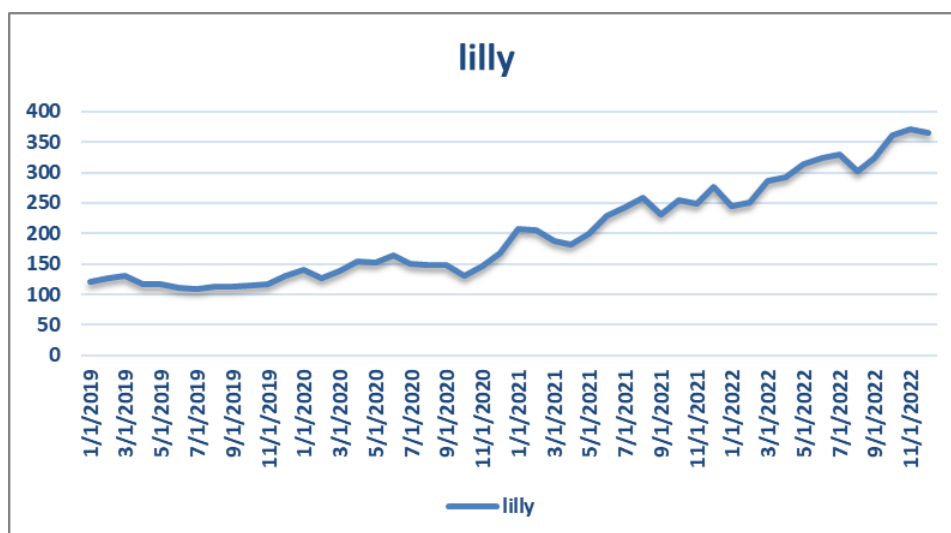


Figure 2. 2019-2022 LLY Stock Price.

Lilly was founded in 1876 by Colonel Eli Lilly, who was dedicated to creating high-quality medicines that met practical needs. Eli Lilly's order is to make the medicine they found better and better. More than 145 years later, Lilly did not change their order with three core values Integrity they built up: Integrity, excellence, and respect for other people. Integrity makes Lilly act in a moral and responsible way to gain and maintain the trust of the people it serves. Employees complete annual

practice training in business ethics and build up a system to help to find the people who break the rules, laws, or policies. Excellence striving and trying best to research cutting-edge drugs. Lilly believes that Diversity, Equity, and Inclusion contributes to creating new medicines, making people's life better all around the world, and being helpful to scientific breakthroughs by respecting other people. Three values lead Lilly employees to speak up and make Lilly have better development.

From January 1st, 2019 to December 31st, 2022, LLY stock price changed from \$108.95 to \$371.08, the mean price of the stock was \$203.25, the standard error is 11.82, the standard deviation is 81.07, the open price was \$119.86, and the closed price is \$365.84. Based on the stock price we can see that Covid-19 has almost no effect or make Lilly better than before, it is because Lilly is a medicine company that makes Lilly more opportunity to develop itself. The mean return of Lilly stock is 2.72% and the standard error is 0.01187.



Figure 3. 2019-2022 AMZN Stock Price.

The third company is Amazon, and its headquarter is in Seattle. As we all know, Amazon is one of the largest online e-commerce companies in the United States, founded in 1995, and Amazon was also one of the earliest companies that start doing e-commerce on its website. Originally, Amazon was an online book sales company, that has grown into an Internet-based business company focused on providing e-commerce, cloud computing, digital streaming, and artificial intelligence (AI) services. The way Amazon sells to buyers enables consumers to buy almost everything, including clothing, cosmetics, food, jewelry, books, movies, electronics, pet supplies, furniture, toys, gardening tools, and household supplies.

From January 1st, 2019 to December 31st, 2022, AMZN stock price changed from \$81.97 to \$175.35, the mean price of the stock was \$129.65, the standard error is 4.8, the standard deviation is 32.92, the open price was \$85.94, and the closed price is \$84.00. Based on the stock price we can see that Covid-19 affected Amazon positively. Most people buy things online instead of going to the store, and after February 2022, Covid did not affect a lot, and the stock price returned to its original price. The mean return of AMZN stock is 2.72% and the standard error is 0.01187.

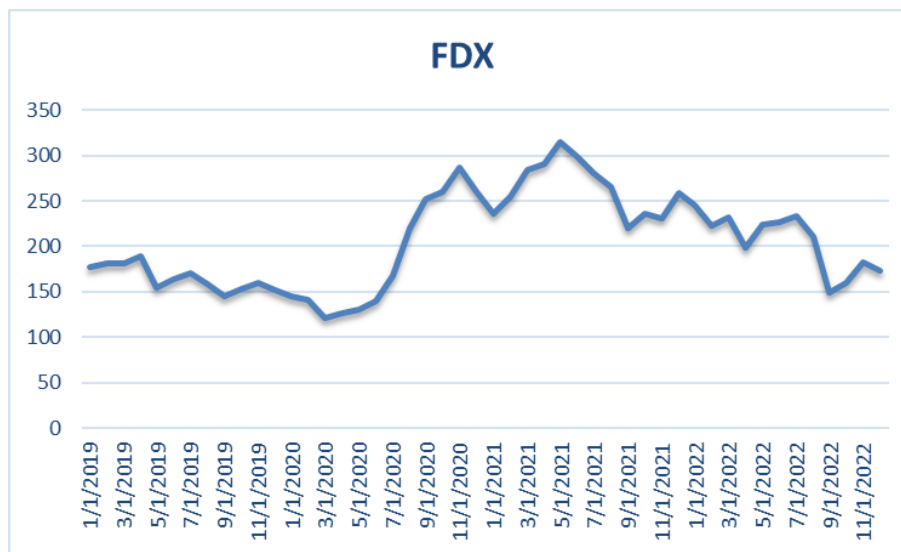


Figure 4. 2019-2022 FedEx Stock Price.

The fourth company is FedEx, FDX Corporation, formerly Federal Express Corporation was founded in Little Rock, Arkansas in 1971 as Federal Express Corporation by Frederick W. Smith. Just like its name, is an express corporation. FedEx is a syllabic abbreviation of the name of the company's original air division. Frederick W. Smith is Executive Chairman, and Raj Subramaniam is the president and CEO of FedEx. In 2022, with 547,000 members corporate together, FedEx's revenue is about \$93.5 billion, net income is more than \$3.8 billion, and total assets are \$85.99 billion.

From January 1st, 2019 to December 31st, 2022, FDX stock price changed from \$121.26 to \$314.81, the mean price of the stock was \$206.03, the standard error was 7.75, the standard deviation is 53.11, the open price was \$177.57, and the closed price is \$173.20. Similar to Amazon stock, the stock price increased during the covid-19 period. Because most people buy things online, the need for express is increased which reflects the FDX stock price increase. After February 2022, the stock price returns to the original price just like AMZN. The mean return of FDX stock is 0.53% and the standard error is 0.01579.

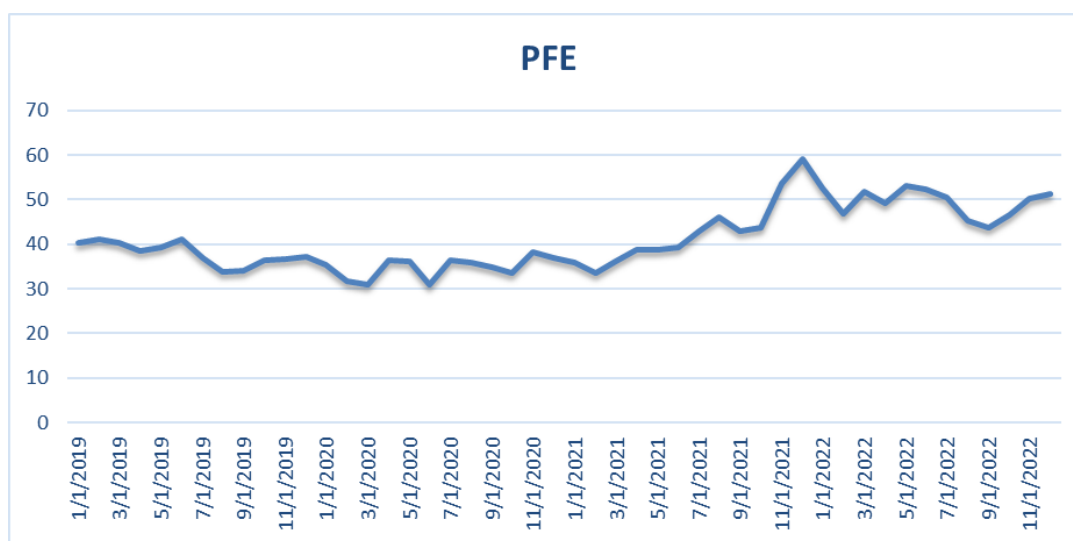


Figure 5. 2019-2022 PFE Stock Price.

The last company is Pfizer (PFE). Pfizer is an American multinational pharmaceutical and biotechnology company, headquartered on 42nd Street in Manhattan, New York City. Pfizer was founded in 1849 in New York by two German entrepreneurs, Charles Pfizer (1824-1906) and his cousin Charles F. Erhart (1821-1891). Early on, the company produced chemical compounds, but

around 1950, as the price of penicillin fell, Pfizer began looking for new antibiotics with greater profit potential. Pfizer's discovery of interracial in 1950 transformed the company from a fine chemical manufacturer into a research-based pharmaceutical company [9-10].

From January 1st, 2019 to December 31st, 2022, FDX stock price changed from \$30.97 in June 2020 to \$59.05 in January 2022, the mean price of the stock was \$41.21, the standard error is 1.035, the standard deviation is 7.10, the open price was \$40.28, and the closed price is \$51.24. The stock price of PFE did not change a lot in recent three years. The mean return of PFE stock is 0.83% and the standard error is 0.01195 (Table 1).

Table 1. 2019-2022 Five Companies' Stock Price Statistic Result.

Column1	JPM	Column2	LLY	Column3	AMZN	Column4	FDX	Column5	PFE
Mean	126.11851 1	Mean	203.24617	Mean	129.65401	Mean	206.03063 9	Mean	41.208339 2
Standard Error	3.2959705 6	Standard Error	11.824574 2	Standard Error	4.8020475 5	Standard Error	7.7463807 7	Standard Error	1.0354290 1
Median	124.91999 8	Median	182.77000 4	Median	126.76999 7	Median	210.80999 8	Median	38.73
Mode	#N/A	Mode	#N/A	Mode	#N/A	Mode	#N/A	Mode	#N/A
Standard Deviation	22.596035 8	Standard Deviation	81.065196 7	Standard Deviation	32.921179 4	Standard Deviation	53.106511	Standard Deviation	7.0985436 4
Sample Variance	510.58083 2	Sample Variance	6571.5661 1	Sample Variance	1083.8040 5	Sample Variance	2820.3015 1	Sample Variance	50.389321 7
Kurtosis	- 1.0912244 7	Kurtosis	- 0.9245542 3	Kurtosis	- 1.6900933 3	Kurtosis	- 1.1194304 8	Kurtosis	- 0.5416455 1
Skewness	0.2495376 4	Skewness	0.5871321 8	Skewness	- 0.0557409 8	Skewness	0.2101632 1	Skewness	0.6700710 3
Range	79.86	Range	262.12999	Range	93.361999	Range	193.54999 6	Range	28.082256
Minimum	90.029999	Minimum	108.94999 7	Minimum	81.991501	Minimum	121.26000 2	Minimum	30.967743
Maximum	169.88999 9	Maximum	371.07998 7	Maximum	175.3535	Maximum	314.80999 8	Maximum	59.049999
Mean Return	0.0090423 6	Mean Return	0.0271917 2	Mean Return	Mean Return	Mean Return	0.0053167 1	Mean Return	0.0083273 1
Standard Error Return	0.0123261 6	Standard Error Return	0.0118788 8	Standard Error	0.0138349 6	Standard Error	0.0157862 2	Standard Error	0.0119485 7

3. Create the Portfolio

3.1 Method Introduction

I used efficient Frontier to create the investment combo to try to earn profits from more than 10 years of US Bond. The efficient frontier is the combo of optimal portfolios that can provide the highest expected return with an acceptable risk or get the lowest risk at a stable level of expected return is a cornerstone of modern portfolio theory (MPT) which was primarily proposed by Harry Markowitz, the Nobel Laureat, in 1952. The formula of the financial portfolio is shown as follows.

$$\sigma_p = \sum w_i w_j \text{cov}(r_i, r_j) \quad (1)$$

$$E(r_i) = \frac{\sum r_i}{m} \quad (2)$$

3.2 the investment portfolio for five stocks

Based on the portfolio function I created an investment portfolio of the five stocks. I made a portfolio by setting the highest weight as 1 and the lowest as -1 because we can either buy or sell the stock. By using solver, I got the highest return combined 2.99% which is higher than the return of 10 Years US bond. And the portfolio risk is lower than 10%. By changing the portfolio risk, the return of the calculation changes from 1.05% to 3.54% which showed in table 4 which showed in figure 8. Table 2-5 showed the return of five stocks in recent three years. The highest covariance is the FDX return of 1.15% (figure 6).

Table 2. The Covariance of Five Stocks

	<i>JPM return</i>	<i>Lilly return</i>	<i>AMZN return</i>	<i>FDX return</i>	<i>PFE return</i>
JPM return	0.70%	0.05%	0.17%	0.43%	0.19%
Lilly return	0.05%	0.65%	0.09%	-0.07%	0.14%
AMZN return	0.17%	0.09%	0.88%	0.32%	0.20%
FDX return	0.43%	-0.07%	0.32%	1.15%	0.29%
PFE return	0.19%	0.14%	0.20%	0.29%	0.66%

Table 3. The Best Weight Proportion for Five Stock

	Weight	ER	w*ER
JPM	54.01%	0.90%	0.4884%
LLY	100.00%	2.72%	2.7192%
AMZN	-45.28%	0.38%	-0.1726%
FDX	-8.75%	0.53%	-0.0465%
PFE	0.03%	0.83%	0.0002%
sum of weight	1.000000005		

Table 4. Portfolio of Five Output

ER(P)	2.99%
RF	2.12%
Portfolio risk	9.63%
SR	9.07%

Table 5. the return based on the change of risk

Portfolio	
Portfolio risk	ER(P)
3.0%	1.05%
5.0%	1.76%
7.0%	2.46%
8.0%	2.77%
10.0%	3.03%
13.0%	3.27%
15.0%	3.40%
17.9%	3.54%



Figure 6. profit of portfolio in different levels of risks

4. Discussion

The main method used in this paper is the efficiency frontier, and the benefits of diversification are quantified. The advantage of a portfolio is that it reduces risk by not putting all your eggs in the same basket. The disadvantage of the efficiency frontier cannot avoid systemic risk, and we need to face individual risks at the same time which cannot allocate the risks. The individual risk and system risk cause sometimes caused the portfolio not to work. There are some other methods used for creating the portfolio like fama-french, Machine Learning.

5. Conclusion

The main purpose of this study is to reduce the risk of buying stocks by means of an investment portfolio. This portfolio uses a portfolio of five stocks to produce a 9.63% risk stock. A maximum investment ratio of 1 makes losses more tolerable.

This paper mainly uses the Markowitz Mean-Variance Model and Effective Frontier to construct five stocks, Eli Lilly, Amazon, FedEx, J.P. Morgan Chase Bank, and Pfizer and uses the data of these five stocks in the past three years to construct this portfolio. The portfolio has a yield of 2.99%, a Sharpe Ratio of 9.07%, and a ceiling of minus 1 per stock, as stocks can be shorted. This is the optimal solution calculated by solving the combination, and its risk is 9.63%. The average return on purchasing the normal Ten Years Treasury Bond is 2.12% which is lower than the optimal yield.

The shortage of this study is that the return rate of the investment portfolio is relatively low. The number of stocks used in the investment portfolio is only five, and the volatility curve of these five stocks is relatively flat. This resulted in a Sharpe ratio of only 9.07%. In future research, I will add more stocks and try to add some stocks with large fluctuations. Then, I will collect the daily closing data of stocks in the past year and a half, and change the investment ratio every month according to the stock price of the last month, so as to increase the investment yield and reduce the risk.

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