

Introduction

This research report provides a brief introduction on pharmaceutical Industry and then brief introduction on three companies operating in pharmaceutical sector in US.

Furthermore, It also explains the reasons behind their stock movement over the years. The data is compiled using WRDS and visualized through R. It also compared the effect of having an equally weighted vs a value weighted portfolio of the stocks.

Pharmaceutical Industry

Pharmaceutical companies research, develop, make, and sell medications, including preventive medicines, treatments, and vaccines. Its revenue has grown to \$1.607 trillion in 2023 from \$390 billion in 2001, a CAGR of 7%. [1] And it is projected to grow further due to increase in life expectancy at birth (Today the life expectancy at birth is at 73.2 years compared to 67.1 years in 2000) and predicted increase in global population (The global population is currently at 8.2bn, and this figure is projected to reach 8.5bn in 2030). [2] Pharmaceutical companies also have significantly bigger profit margins as compared to other large companies. A 2020 study of corporate earnings from 2000 to 2018 found that pharmaceutical companies had average net incomes of 13.8%, compared to the average of 7.7% for companies in the S&P 500. [3]

Pharmaceutical Industry also benefits from strong pricing power for medications that have patent protection since other companies cannot replicate the formula. Pharmaceutical Industry also benefits from high barriers to entry, as companies require huge investments for R&D and salary of highly trained scientists, which is out of reach for most new companies. [2]

Pharmaceutical companies are also less adversely impacted from recessions as compared to other sectors. It is due to the reason that people will need their medications even in bad economic conditions. According to the Centers for Disease Control and Prevention, about 49% of the people in the U.S. have used at least one prescription medication in the last 30 days and 24% have used 3 or more. This results in stable cash flows for the company making these medication. [4]

Furthermore, even though firms developing new drugs are highly risk, they have low beta. For example. – Consider a pharmaceutical firm with 1 revolutionary drug in R&D. If the drug passes all the trials for safety and effectiveness, then the company will have great returns but if the drug doesn't pass all the trials and isn't considered safe, then the stock will most probably crash. Hence, the stock is highly risk, but it is unsystematic risk as this risk relates to the individual conditions of the company. Since, broader market conditions don't have a huge result on the returns of the stock, the stock will have a low systematic risk(beta). In a portfolio of 100 such stocks, we can expect some companies to achieve success in their trial while the rest of them to fail and hence, unsystematic risk will be diversified away in the portfolio. Since, the unsystematic risk can be diversified away in a portfolio, portfolio consisting of many such pharmaceutical stocks can provide very stable returns since it will have low systematic risk.

One of the disadvantages of investing in Pharmaceutical Industry is that it is highly regulated and supervised, both globally (international standards) and locally (FDA in the US or EMA in Europe). Second, Patents last only 20 years on average and once, the patent expires, it can decrease the sales of the branded drug by around 70%-80%. [2] Third, on average, it takes at least a decade and around \$2.6 billion for a medication to make it to pharmacy from a scientist's notebook. So, the process is highly lengthy and expensive. [3] Fourth, the success rate of a medication, from the beginning of the trial to receiving approval from the regulators, is currently at about 10%–20%, and it has been constant from the past few decades. Thus, the process is highly risky. [5]

But still today, we don't have medications for the cure and prevention of hundreds of diseases, hence there is still a lot of room for growth and development in the pharmaceutical industry. As of 2024, 16000 different cancer related medications are in the pipeline, of which 43% are in the pre-clinic phase and 18% in the discovery phase. With 5,775 medication in the pipeline, immunology holds second place and with 1400 medications in the pipeline, diabetes takes the third place. [2]

CYMABAY THERAPEUTICS INC

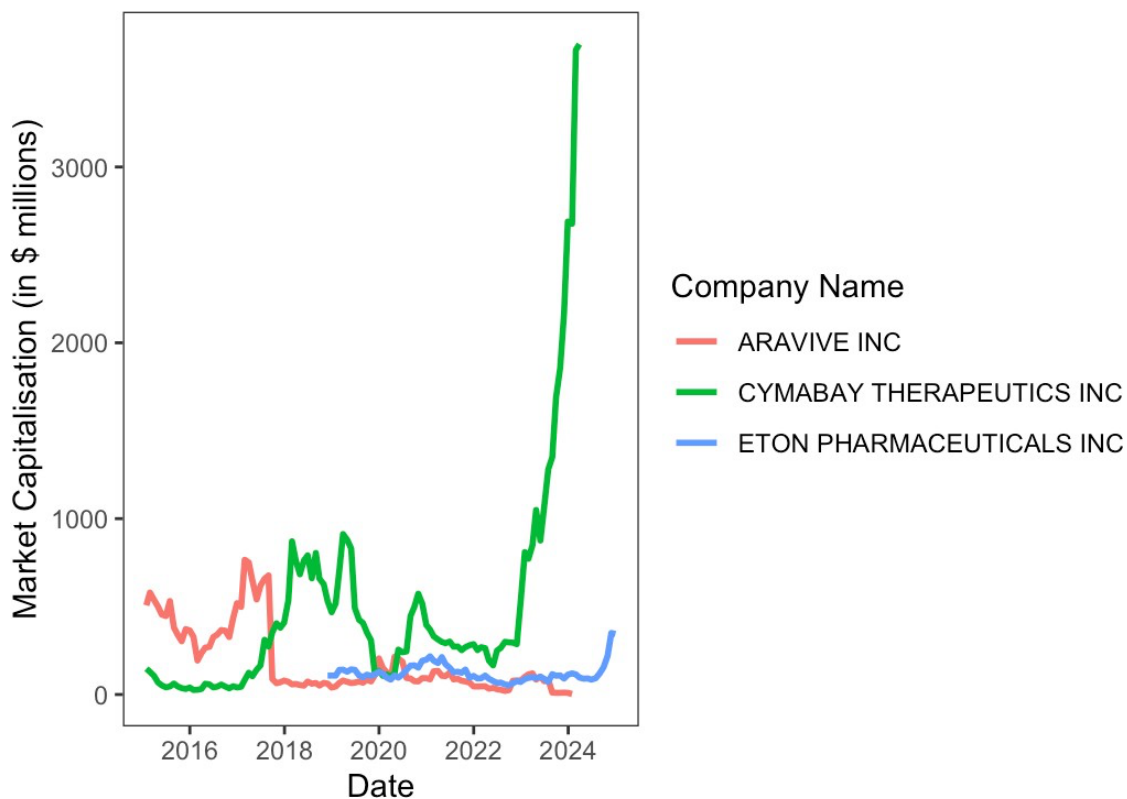
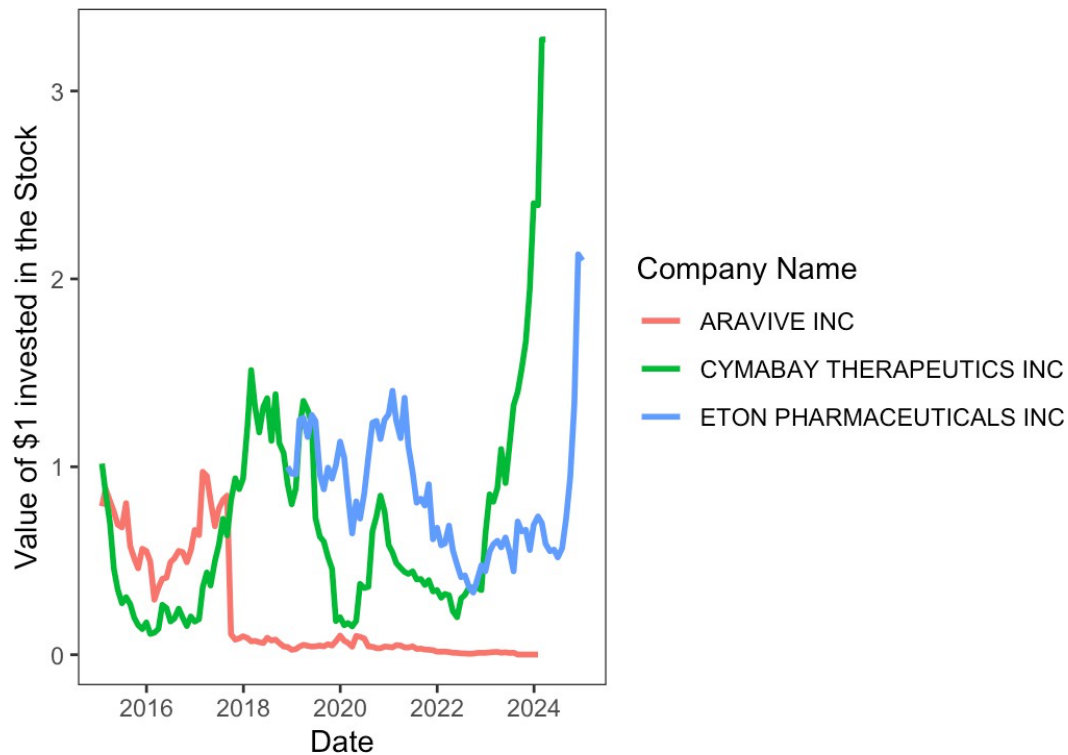
CYMABAY THERAPEUTICS INC is a biopharmaceutical company mainly focusing on treating people with liver problems. Seladelpar, a blockbuster drug created by CYMABAY, which treats people with primary biliary cholangitis (PBC), have achieved breakthrough therapy designation (FDA), PRIME status (EMA) and orphan drug status in United States and Europe. [6] CYMABAY is headquartered in Newark, California, the US. [7]

ARAVIVE INC, formerly VERSARTIS INC

ARAVIVE INC is a biopharmaceutical company that develops treatments for diseases such as cancer and fibrosis in the United States. Its main product (batiraxcept) is in phase III trial for treatment of ovarian cancer and in phase II trial for clear cell renal cell carcinoma and pancreatic adenocarcinoma. The company changed its name to ARAVIVE from VERSATIS after merging with ARAVIVE in October 2018. Currently, the firm is headquartered in Houston, Texas. [8]

ETON PHARMACEUTICALS INC

Eton Pharmaceuticals Inc is a pharmaceutical company with a portfolio of diverse medications. Its main products are Alkindi Sprinkle which is used for the treatment of adrenocortical insufficiency, Carglumic Acid for hyperammonemia, Betaine Anhydrous for homocystinuria; and Nitisinone hereditary tyrosinemia type 1 (HT-1). The company also have two medications in late stage development which are ET-600, and ZENEO hydrocortisone autoinjector. Eton Pharmaceuticals is headquartered in Deer Park, Illinois, U.S. [9]



I have adjusted the graphs for merger of ARVIVE and VERSARTIS to make data easier to analyze

Market Cap and Price Return

CYMABAY THERAPEUTICS INC

2017

We can observe the Market Capitalization and stock price of CYMABAY skyrocketing in 2017. It is

due to the positive results from the trial of its main drug named seladelpar. [10][11]

2019

We can observe a pretty steep decline in the market valuation and stock price of CYMABAY in late 2019. It is because CYMABAY had to stop the trial of its drug seladelpar in nonalcoholic steatohepatitis (NASH) and primary sclerosing cholangitis (PSC) after biopsies found liver damage in some patients. This caused the company's stock to crash more than 75%. [12]

2020

In 2020, the market capitalization and stock price of CYMABAY surged again. It is due to Food and Drug Administration (FDA) lifting clinical holds on the trial of seladelpar. It is because an independent, expert panel review found no clinical, biochemical or histological evidence of seladelpar causing any liver damage in the patients in the phase II study and all of them supported restarting the clinical trial of seladelpar. Based on this recommendation, FDA allowed restarting clinical trial of seladelpar for the treatment of nonalcoholic steatohepatitis (NASH) and primary sclerosing cholangitis (PSC) and Primary biliary cholangitis (PBC). [13][14] Furthermore, in 2020, CYMABAY's seladelpar showed positive outcome in Phase III PBC trial, boosting the stock even more. [15]

2023

On September 7, 2023, CYMABAY announced results from their seladelpar Phase III RESPONSE study. The study evaluated the safety and efficiency of seladelpar for the treatment of Primary biliary cholangitis (PBC). The trial achieved all key endpoints. This led to their market capitalization and stock price being skyrocketed in 2023. [16][17]

In September 2023, they issued 14,521,307 shares of common stock at the price of \$17.13 per share and pre-funded warrants to purchase 583,771 shares of common stock at \$17.1229 per share. In total, the company raised \$242.8 million, after accounting for the underwriting expense and other offering expenses. This led to an increase in the market capitalization of the company. [16]

2024

Finally in 2024, Gilead bought CYMABAY for \$4.3B which led to increase in market capitalization of the company to \$4.3 billion. [18]

ARAVIVE INC, formerly VERSARTIS INC

2017

The market capitalization and stock price of VERSARTIS crashed in September 2017 after VERSARTIS reported its experimental human growth hormone somavaratan came up short compared to a rival drug in a Phase 3 trial. VERSARTIS's somavaratan given twice monthly failed to demonstrate non-inferiority to Pfizer Inc.'s once-daily Genotropin in the study's intent-to-treat population. This caused the stock to crash by 85%. [19]

2018

In 2018, ARAVIVE and VERSARTIS Biologics agreed to create a new entity by merging the clinical-stage oncology biopharma with a wholly owned VERSARTIS subsidiary in an all-stock transaction and subsequently, the company was renamed to ARAVIVE. VERSARTIS' share price spiked 24% on the news. [20]

2022

In October 2022, ARAVIVE INC issued and sold a total of 45,178,811 share of its common stock and warrants to purchase up to a total of 45,178,811 hares of its common stock in a price placement. This offering was priced at the market under NASDAQ rules. This offering raised a total of \$41.5 million, before deducting placement agent fees and other expenses.[\[21\]](#) This led to an increase in market capitalization of the stock.

2024

In January 2024 ARAVIVE was delisted because it was not able to maintain a minimum closing bid price of \$1.00 per share as required by Nasdaq Listing Rule 5450(a)(1). This also caused the stock to drop by 52.3% and market capitalization of the company to drop further. [\[22\]](#)

ETON PHARMACEUTICALS INC.

2024

Launched rare disease product Nitisinone- ETON launched Nitisinone in February 2024 with full patient support services. The market for this product is estimated to be of about \$50 million annually. [\[23\]](#)

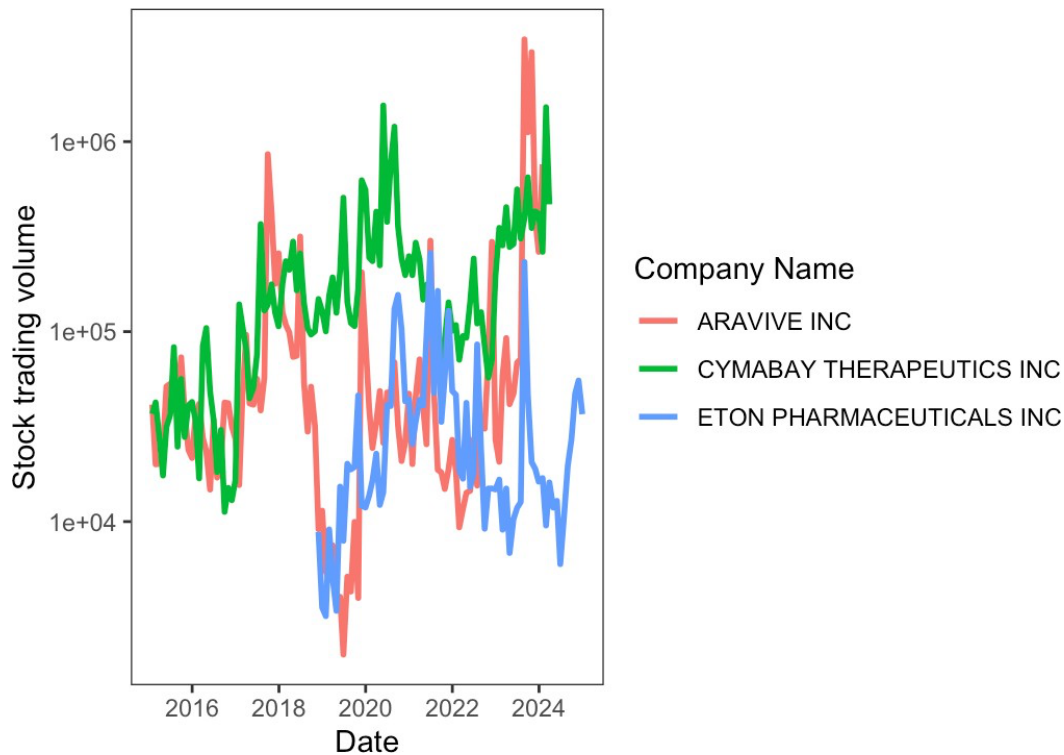
Launched PKU GOLIKE, a medical formula for patients with phenylketonuria (PKU) – ETON acquired PKU GOLIKE in the first quarter and then launched the product under its own infrastructure in April. Furthermore, since the initiation of the promotional activities for the product, company has seen an increased number of patient referrals. [\[24\]](#)

Strong growth of ALKINDI SPRINKLE and the Company's metabolic portfolio - 55% year-over-year revenue growth in Q3 2024 was reported for ALKINDI SPRINKLE. [\[25\]](#)

New Drug Application (NDA) for ET-400 accepted by the U.S. Food and Drug Administration (FDA) – In July of 2024, the U.S. Food and Drug Administration accepted ETON's New Drug Application for its propriety patented formulation of hydrocortisone oral solution, known as ET-400. ET-400 and ALKINDI SPRINKLE, are projected to achieve a combined sales of \$50 million annually. [\[25\]](#)

Initiation of ET-600 pivotal study – Study to test the safety and efficiency of ET-600 had also been initiated. ET-600 will be used for the treatment of the pediatric endocrinology condition diabetes insipidus. If the results of the study are positive, then the company expects to submit the New Drug Application (NDA) for the medication in the first quarter of 2025. [\[25\]](#)

All this reasons caused a huge increase in Market Capitalization and stock price of Eton Pharmaceuticals during 2024.



STOCK TRADING VOLUME CYMABAY THERAPEUTICS INC

We can observe CYMABAY's trading volume surged in 2020 when Food and Drug Administration (FDA) lifted all clinical holds on seladelpar and during 2024, when its merger with GILEAD SCIENCES was announced.

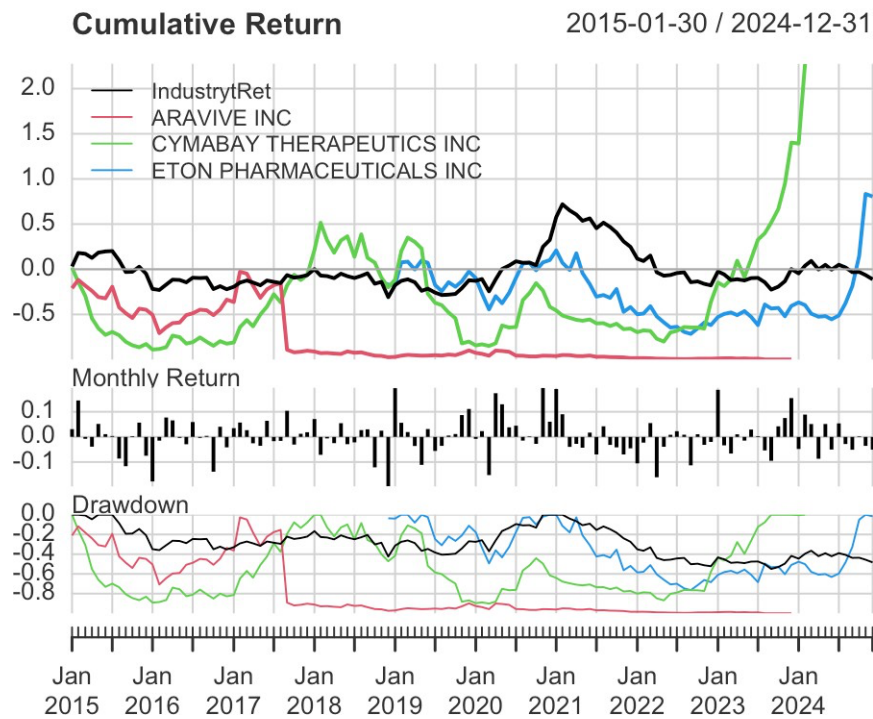
ARVIVE INC, formerly VERSARTIS INC

Its share trading volume surged rapidly in January 2024 when its delisting from NASDAQ was announced. [\[22\]](#)

ETON PHARMACEUTICALS INC

We can observe its trading volume rising rapidly during end of 2021 when its share price was falling fast.

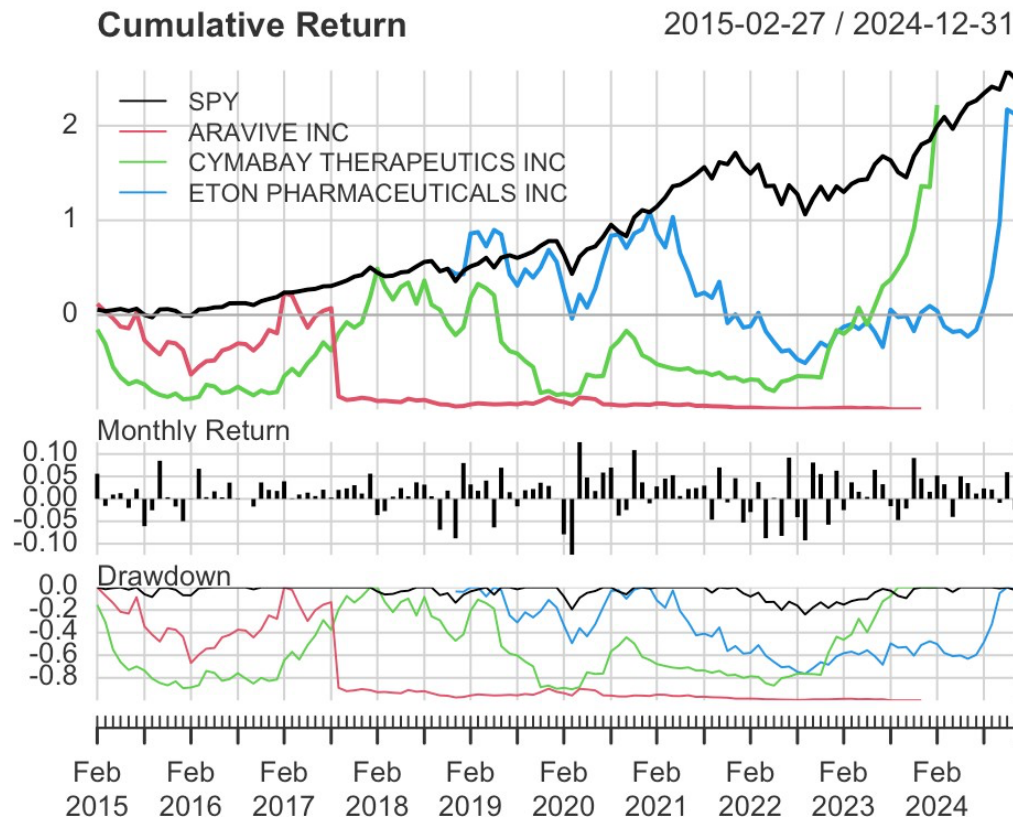
Pharmaceutical Industry vs Stocks



5)

We can observe from the graph above that CYMABAY and ETON was able to outperform the industry index whereas ARAVIVE was not able to outperform the industry index.

Market vs Stocks



We can observe from the graph above that CYMABAY was able to outperform the market whereas ARAVIVE and ETON was not able to outperform the market.

Portfolio Investment and Evaluation

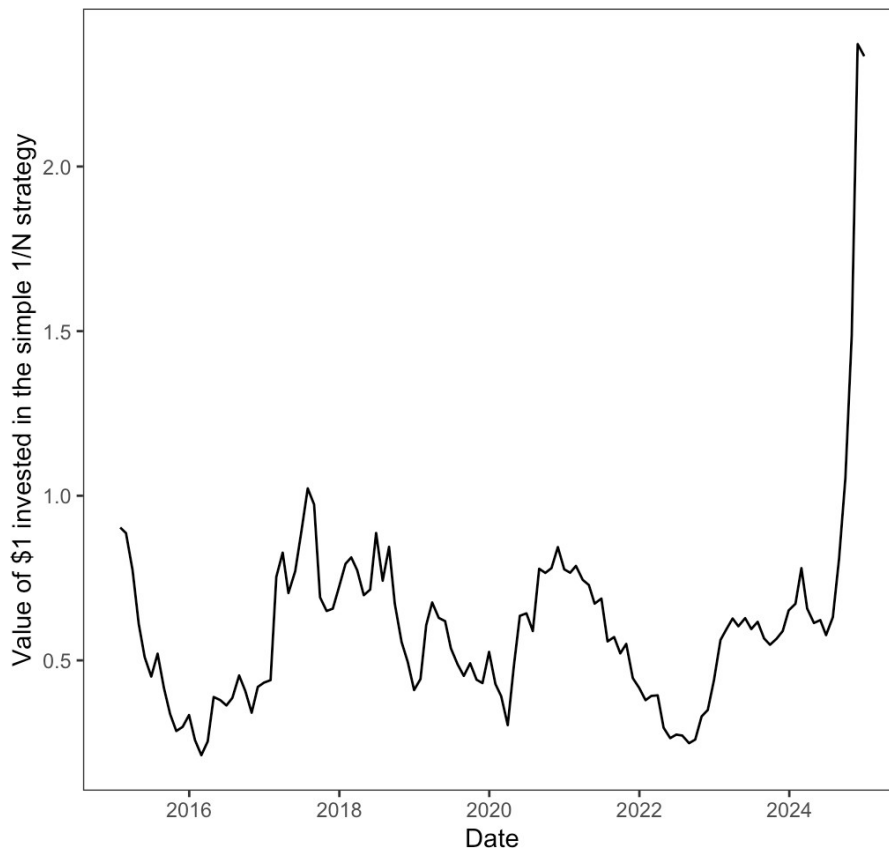
1) Equally Weighted Portfolio

This portfolio assigns an equal weight to each constituent security at inception.

The primary advantages of equally weighted portfolios is its simplicity and the diversification provided in case any sector of the economy, or any company is overvalued in the stock market. For example: In 1999, tech sector was very overvalued, and it constituted a huge part of the market and when the tech bubble exploded, its impact was much severe on the overall market as compared to equally weighted portfolio. It is because Tech Giants like Microsoft and Cisco, whose stock prices tanked were a huge part of the overall market but a small part of the equally weighted portfolio.

But It also have some disadvantages, mainly that it must be periodically adjusted so that all the stocks in the portfolio are equally weighted. Over time, this translates to huge trading costs which reduces the net return of the portfolio. Second, It doesn't consider specific risk and return characteristics of its individual assets, so Equal Weighting may not be the most efficient way to construct a portfolio.

Nevertheless, the equally weighted portfolio remains a popular approach for investors who prioritize simplicity and ease of use.



Portfolio Variance of equally weighted portfolio = 0.0320

Sharpe Ratio of equally weighted portfolio = 0.1097238

2) Value-Weighted Portfolio

A value-weighted portfolio, also known as a market-value-weighted portfolio, is a type of investment portfolio in which the weights of individual assets are based on their market capitalization.

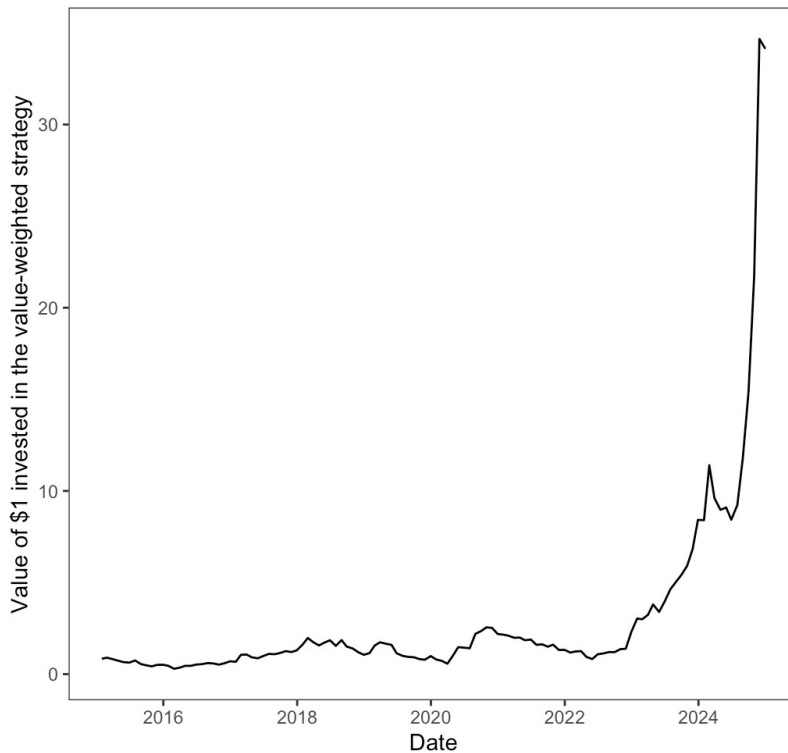
In a value-weighted portfolio, the larger companies with higher market capitalizations have a greater impact on the overall portfolio performance than smaller companies with lower market capitalizations. This is because the larger companies make up a larger proportion of the portfolio, reflecting their larger presence in the overall market.

One advantage of a value-weighted portfolio is that it reflects the overall market capitalization of the underlying index or market, which can help to reduce the potential tracking error relative to the market. Other advantage is that since the portfolio doesn't have to be rebalanced frequently, the trading costs are much lower than equally weighted portfolio.

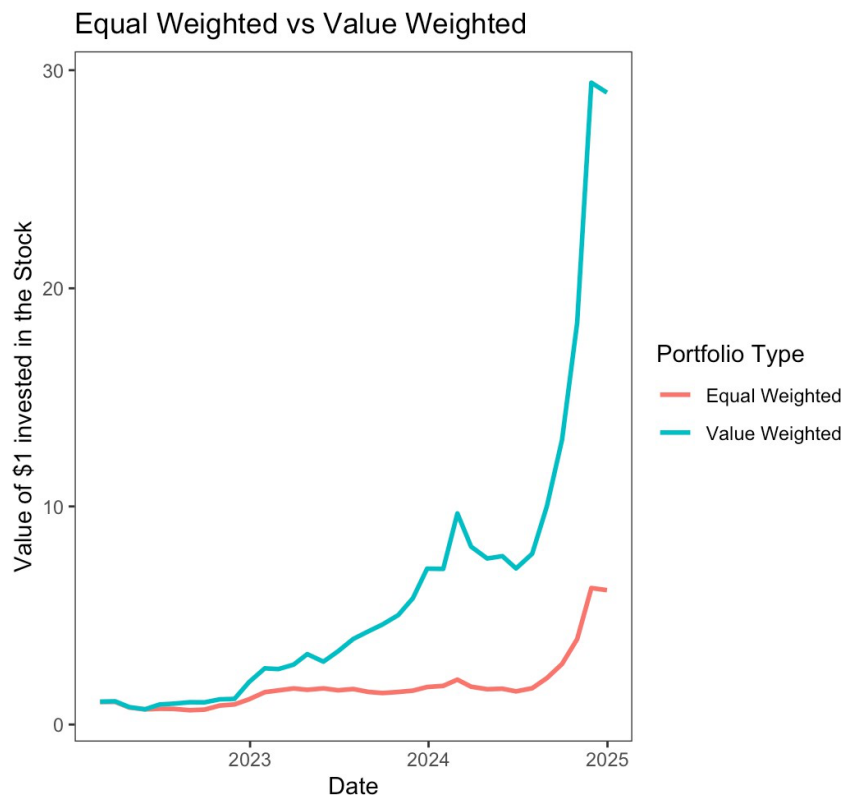
But it is riskier as compared to other portfolios as it is heavily invested in companies with bigger market capitalizations. For example: The Magnificent 7 (Apple, Microsoft, Alphabet, Amazon, Nvidia, Meta, and Tesla) collectively account for approximately 32% of the S&P 500's total market capitalization as of March 2025. This makes the portfolio much less diversified than it should be.

Second, It doesn't consider specific risk and return characteristics of its individual assets, so Value Weighting may not be the most efficient way to construct a portfolio.

Overall, value-weighted portfolios can be a useful approach for investors who want to closely track the performance of the overall market and who are willing to accept the potential concentration risk of investing in the largest companies.



The market weighted portfolio outperformed the equal weighted portfolio by a considerable amount. This is due to outperformance of companies with greater market capitalization (CYMABAY) as compared to companies with smaller market capitalization (ARAVIVE, ETON). The greater market capitalization and returns of CYMABAY as compared to ARAVIVE and ETON can also be observed from the market capitalization and price return graph of the stocks pasted above.



We can notice that a lot of outperformance occurred during the period of start of 2023 to end of March 2024. The reason for that is the huge market capitalization of CYMABAY as compared to ETON and ARAVIVE and its spectacular performance during that period which saw its share price increase from 3.38 during start of 2022 and increase to 32.5 in March of 2024.

The market capitalization of CYMABAY was 286 million during start of 2022 and 3698 million during end of March 2024 as compared to total market capitalization of all three stocks of 438.1 million during start of 2022 and 3794.3 million during end of March 2024.

This huge market capitalization of CYMABAY caused great returns in value weighted portfolio but in equal weighted portfolio, CYMABAY accounted for only 1/3 of the returns from start of 2022 to end of 2023 and 1/2 of returns from start of 2024 to end of March 2024. (It accounted for 1/2 the returns from start of 2024 to march of 2024 because ARAVIVE was delisted in December of 2023.)

The returns of both the portfolios are same from April 2024 onwards because only one stock i.e. ETON remained listed out of all the three stocks.

Portfolio Variance of value weighted portfolio = 0.03775887

The portfolio variance of value weighted portfolio is higher as compared to equal weighted portfolio because of higher variance of return of company with greater market capitalization (CYMABAY) as compared to companies with smaller market capitalization (ARAVIVE, ETON). This can be observed from the market capitalization and price return graph of the stocks pasted above.

Sharpe Ratio of value weighted portfolio = 0.2301586

The value weighted portfolio has higher Sharpe ratio as compared to equal weighted portfolio because of much greater return of value weighted portfolio as compared to equal weighted portfolio. Even though Value weighted portfolio have a higher variance, as compared to equal weighted portfolio. It still has a higher Sharpe ratio, as compared to equal weighted portfolio.

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