

Pharmaceutical Stock Prices and Healthcare Spending Trends: 2018-2022 Analysis

Data Visualization Final Project Report

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Introduction

The pharmaceutical industry stands at the forefront of innovation, continually striving to address global healthcare challenges and improve patient outcomes. Within this dynamic landscape, companies such as AbbVie US LLC, GlaxoSmithKline, Eli Lilly & Co., Bayer Pharmaceutical Division, and Bausch Health U have emerged as key players, driving advancements in drug development and therapeutic interventions. This project embarks on a comprehensive exploration of the pharmaceutical sector's financial landscape, focusing on the trends and dynamics of stock prices for these prominent companies.

From 2018 to 2022, I aim to analyze the intricate relationship between pharmaceutical stock prices and healthcare spending trends. By integrating data from two sources and employing analytical techniques, I seek to uncover correlations, patterns, and insights that may inform strategic decision-making within both the financial and healthcare sectors.

Research Questions

1. How do the trends of pharmaceutical stock prices vary over time for AbbVie US LLC, GlaxoSmithKline, Eli Lilly & Co., Bayer Pharmaceutical Division, and Bausch Health U?
2. Is there a noticeable relationship between the average stock close price and Medicare Part D spending trends across the years?

These research questions serve as the guiding framework for the project's analysis, aiming to shed light on the financial performance of select pharmaceutical companies and their potential correlations with healthcare spending trends. By exploring these questions with a focus on data ranging from 2018 to 2022, this project endeavors to provide valuable insights into the dynamics of the pharmaceutical industry during this period.

Data Source

In this project, I utilized two primary data sources to conduct the analysis: pharmaceutical stock data and Medicare Part D spending data.

- **Pharmaceutical Stock Data:** The stock data for AbbVie US LLC, GlaxoSmithKline, Eli Lilly & Co., Bayer Pharmaceutical Division, and Bausch Health U was obtained from NASDAQ(https://www.nasdaq.com/market-activity/stocks/lly/historical?page=1&rows_per_page=10&timeline=y10). The dataset includes

information such as high, low, close prices, symbol, name, date, and volume spanning from the years 2018 to 2022. This data provides insights into the performance of these pharmaceutical companies in the stock market over the specified period.

- **Medicare Part D Spending Data:** The Medicare Part D spending data was sourced from the official data portal of the U.S. government, Data.gov (<https://catalog.data.gov/dataset/medicare-part-d-spending-by-drug-401d2>). This dataset contains information about brand name, generic name, manufacturer name, total spending, total beneficiaries, and total claims for various drugs covered under Medicare Part D. The data spans from 2018 to 2022 and is organized by year and manufacturer name. This data enables the analysis of healthcare spending trends associated with specific pharmaceutical products over the specified time frame.

The pharmaceutical stock data and Medicare Part D spending data were merged based on common attributes such as year and company name/manufacturer name.

Stock Data and Healthcare Spending Analysis

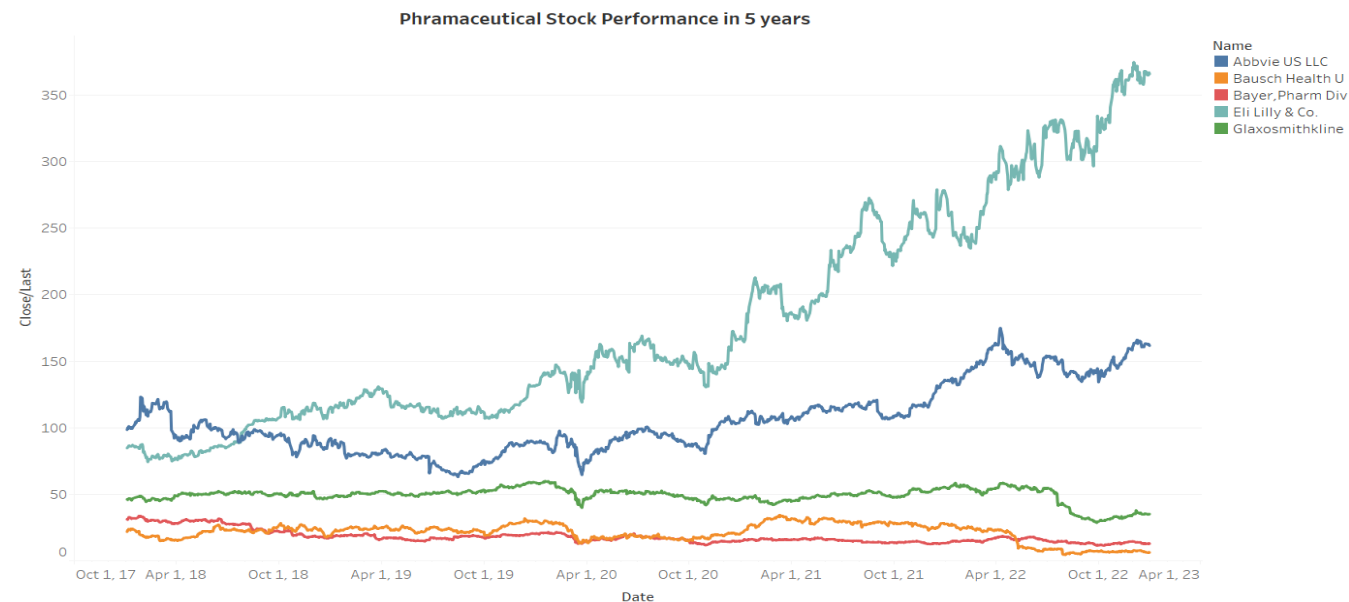
Visualization 1: Stock Performance Over 5 Years

This plot illustrates the close price of stocks for all five pharmaceutical companies over the period from 2018 to 2022. Each line represents a different company, allowing for a comparison of their stock performance over time.

Insights:

- Eli Lilly & Co. exhibits a notable uptrend in its stock price over the five-year period, showing consistent growth. The curve appears almost linear, indicating strong performance.
- AbbVie US LLC demonstrates significant improvement in stock performance, particularly evident after April 2020. The stock price shows an upward trend, suggesting favorable market sentiment and potential growth opportunities.
- Bayer, Pharm Div, GlaxoSmithKline, and Bausch Health U, on the other hand, show relatively stagnant or declining performance. Their stock prices remain relatively constant, with some fluctuations, and exhibit a downward trend, especially in the year 2022.

Overall, this visualization highlights the varying performance of pharmaceutical stocks over the five-year period, with Eli Lilly & Co. and AbbVie US LLC standing out as top performers, while others show limited growth or declining trends.

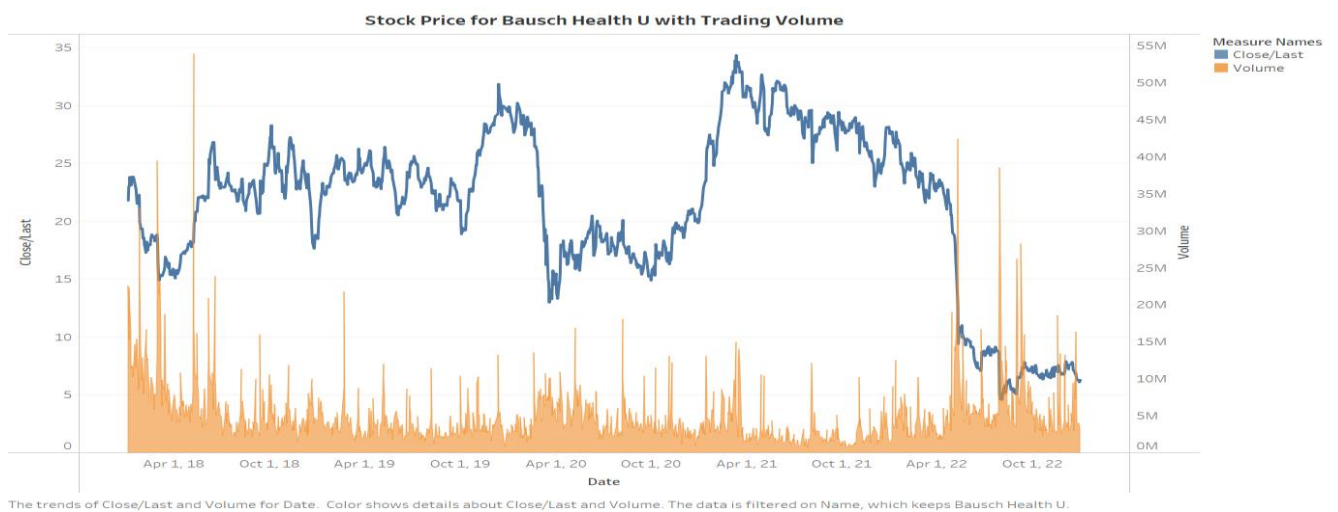
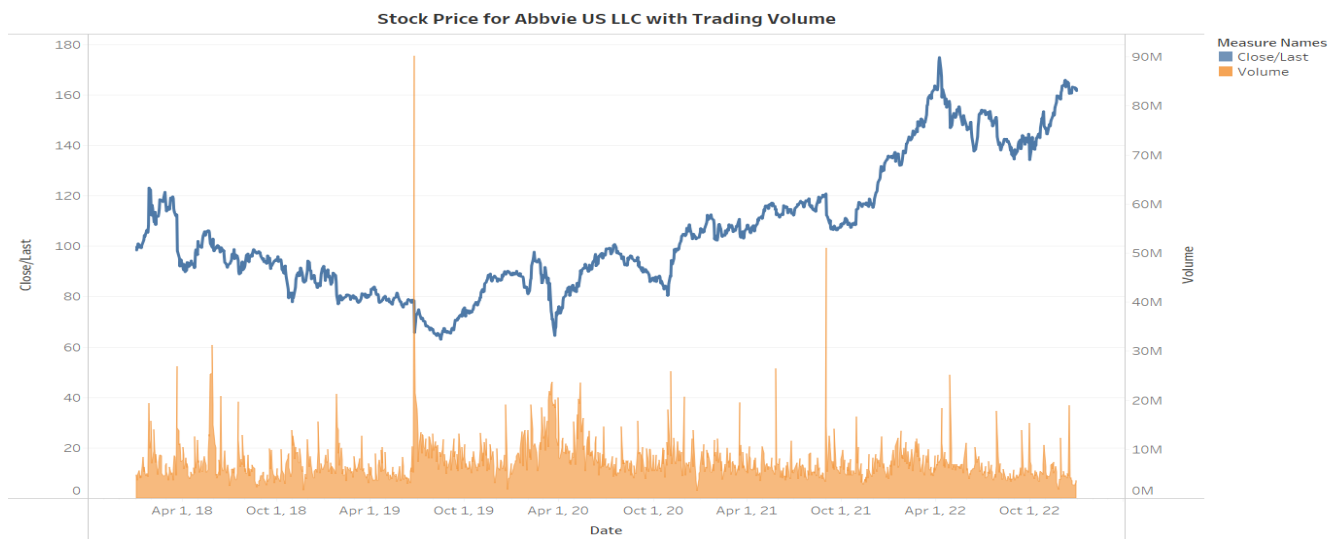


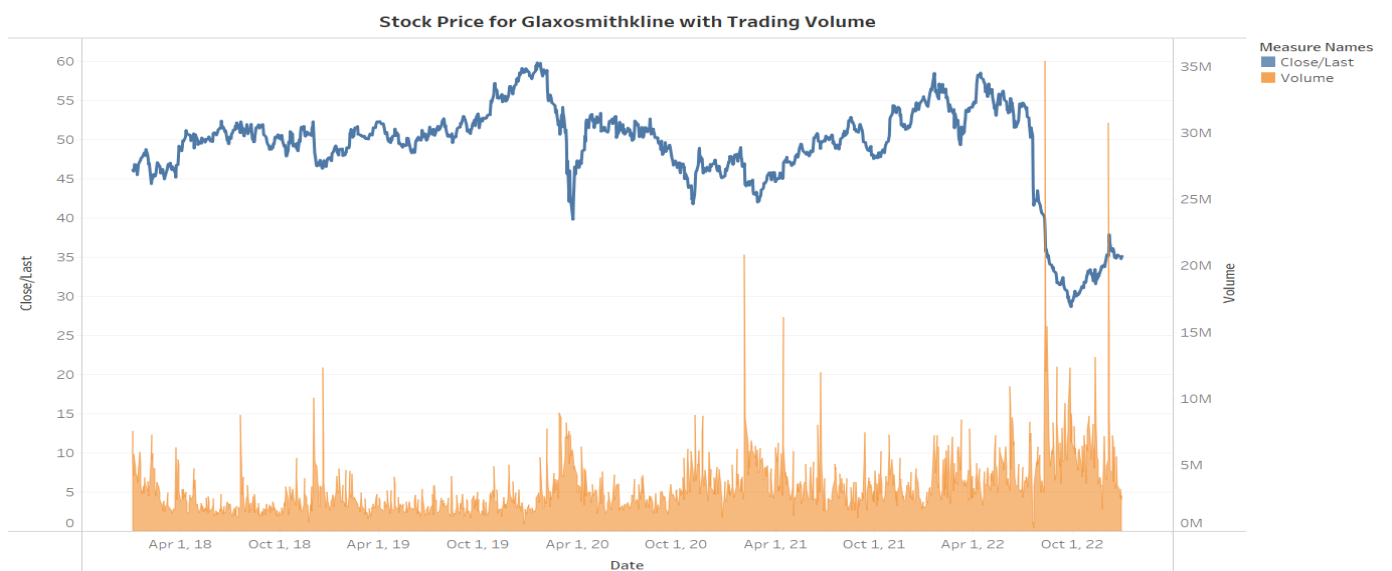
Visualization 2: Close Price and Volume Trends Over Time

The second visualization presents the close price and volume trends over five years for the selected pharmaceutical companies. It provides insights into the trading activity and sentiment surrounding each company's stock.

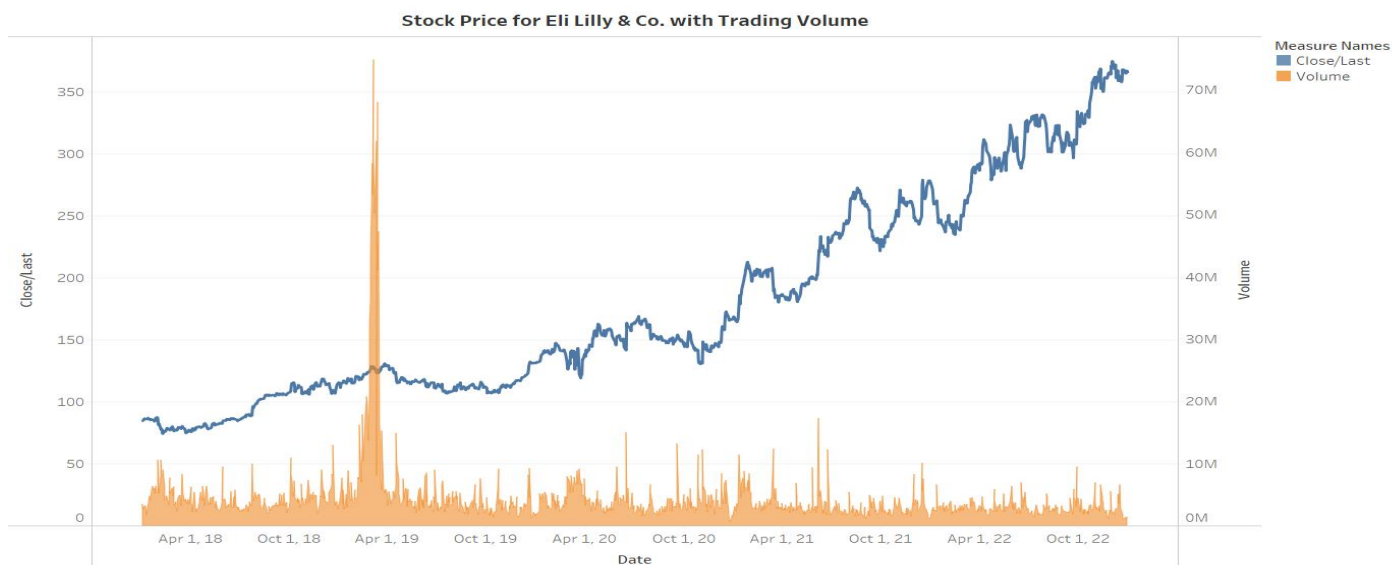
- For Eli Lilly & Co., a notable surge in trading volume is observed in March 2019, suggesting heightened buying sentiments during that period. Despite occasional spikes, the volume remains relatively consistent over time, indicating sustained investor interest.
- AbbVie US LLC exhibits pronounced spikes in volume, particularly in June 2019, possibly driven by significant market events or quarterly result announcements. The stock consistently experiences active trading, reflecting investor confidence and market activity.
- Bausch Health U shows frequent spikes in volume, indicating periods of intense trading activity. The high-volume trading in 2018 and 2022 suggests significant market movements and sentiment shifts, possibly influenced by company-specific developments or broader market trends.
- Bayer's volume spikes coincide with periods of falling stock prices, notably in August 2018, August 2019, and August 2021. These spikes may reflect increased trading activity during market downturns or periods of uncertainty.
- GlaxoSmithKline experiences prominent volume spikes in August 2022 and December 2022, coinciding with declines in stock prices. These spikes may indicate heightened trading activity during periods of market volatility or company-specific news events.

Overall, the visualization highlights the dynamic nature of stock trading, with volume spikes often correlating with significant market events or changes in investor sentiment. These insights can inform investment strategies and risk management approaches for stakeholders in the pharmaceutical industry.





The trends of Close/Last and Volume for Date. Color shows details about Close/Last and Volume. The data is filtered on Name, which keeps Glaxosmithkline.



The trends of Close/Last and Volume for Date. Color shows details about Close/Last and Volume. The data is filtered on Name, which keeps Eli Lilly & Co..

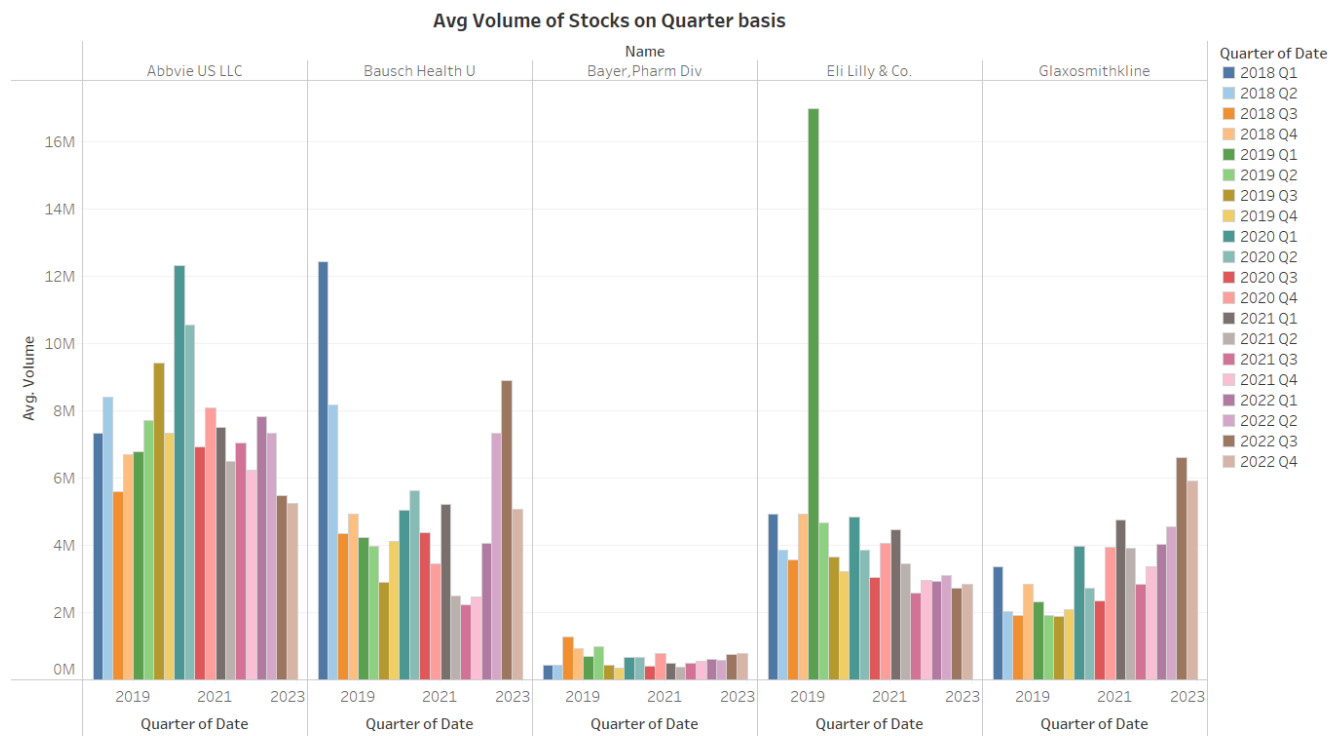
Visualization 3: Quarterly Average Volume Trends

This plot illustrates the quarterly average trading volume for selected pharmaceutical companies over five years. It highlights notable fluctuations and trends in investor activity.

- Eli Lilly & Co. saw a peak in volume during Q1 2020, indicating heightened trading activity, possibly driven by significant market events.
- Bausch Health U experienced a spike in Q1 2018, reflecting increased trading volumes during that period.
- Bayer's volume remained relatively stable across quarters, suggesting consistent investor interest.

- Eli Lilly & Co. witnessed another peak in Q1 2019, likely influenced by market dynamics or company announcements.
- GlaxoSmithKline shows a steady increase in volume since Q3 2019, reflecting changing market sentiment or external factors impacting trading activity.

Overall, this visualization provides insights into trading patterns, offering a snapshot of investor behavior in the pharmaceutical stock market.



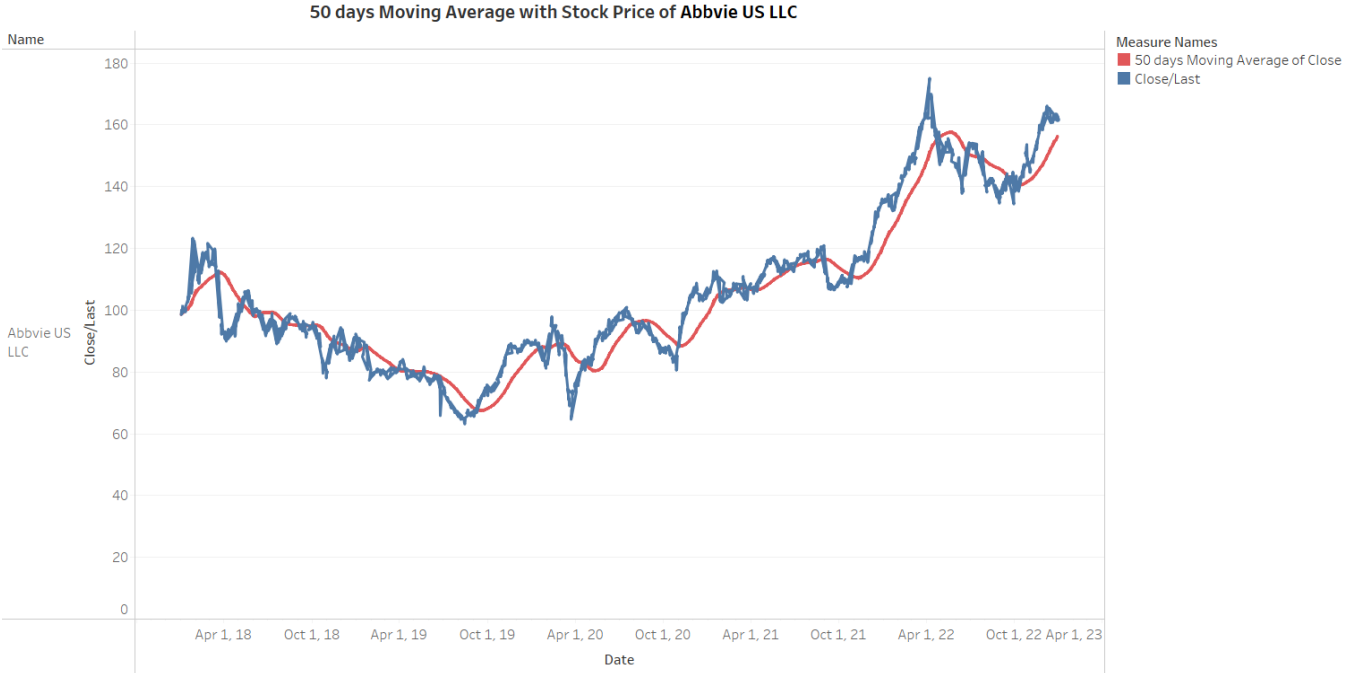
Visualization 4: 50-Day Moving Average vs. Close Price Over Time

This plot juxtaposes the 50-day moving average of pharmaceutical stock close prices with their actual close prices over time, offering insights into stock performance trends.

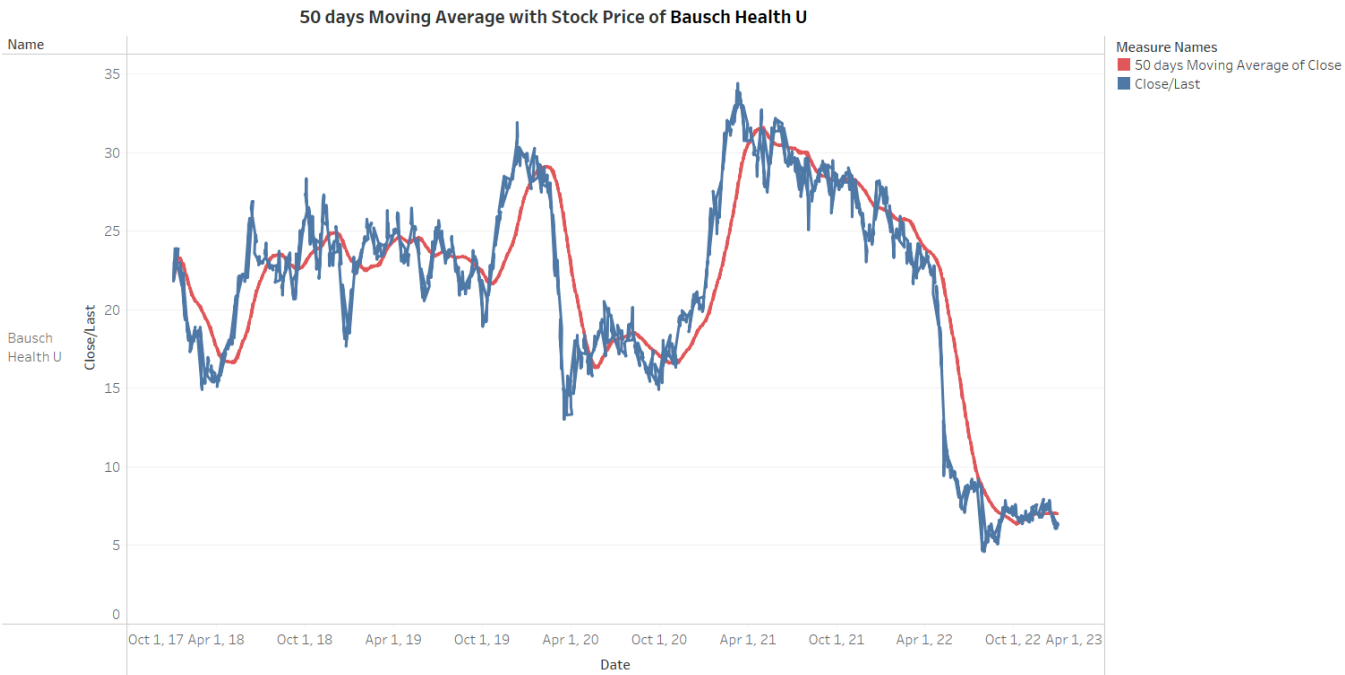
Insights:

- Consistent Trends: Companies like Eli Lilly & Co. (LLY) and AbbVie US LLC (ABBV) demonstrate relatively stable stock performance, with their actual close prices closely tracking the 50-day moving average.
- Volatility: Bayer, Pharm Div (BAY), GlaxoSmithKline (GSK), and Bausch Health U (BHC) exhibit varying degrees of volatility, with fluctuations in actual close prices deviating from the moving average.

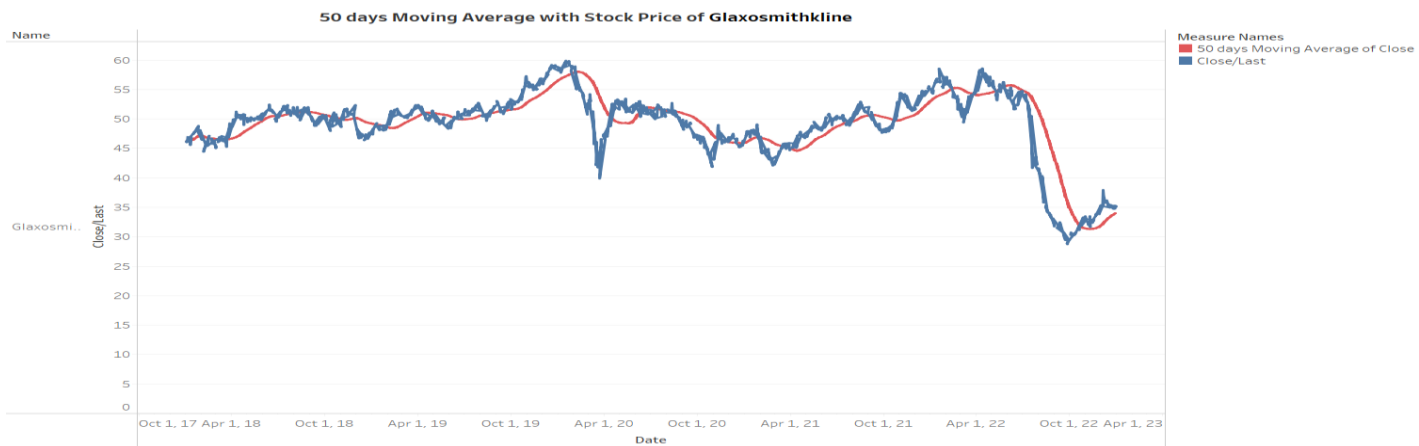
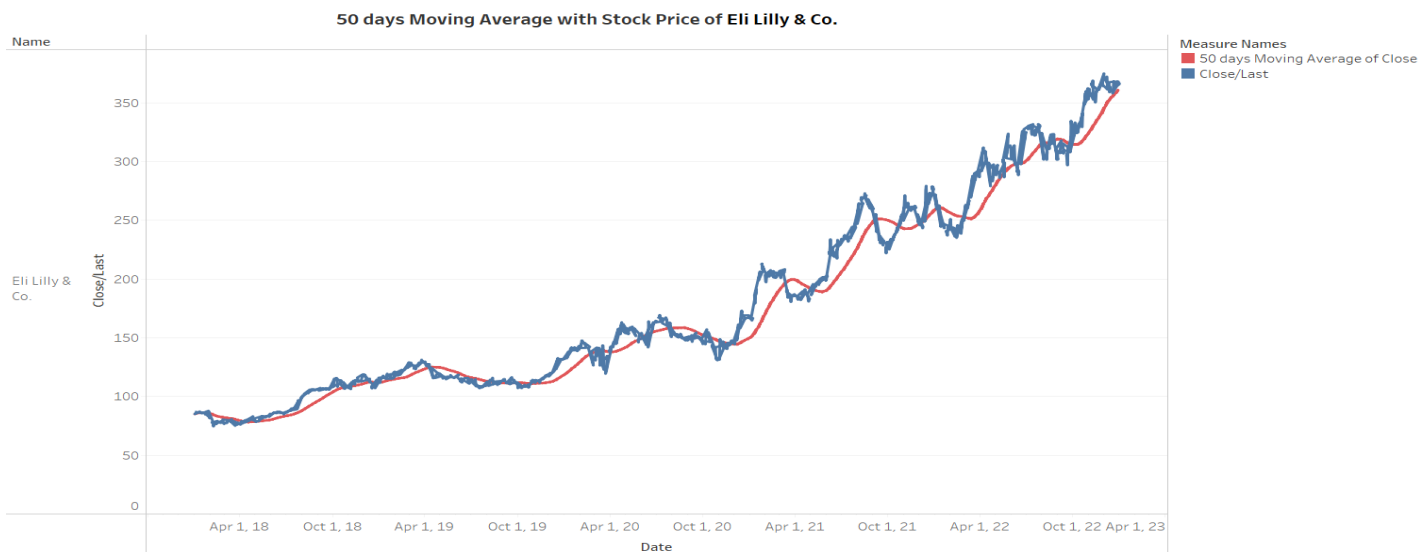
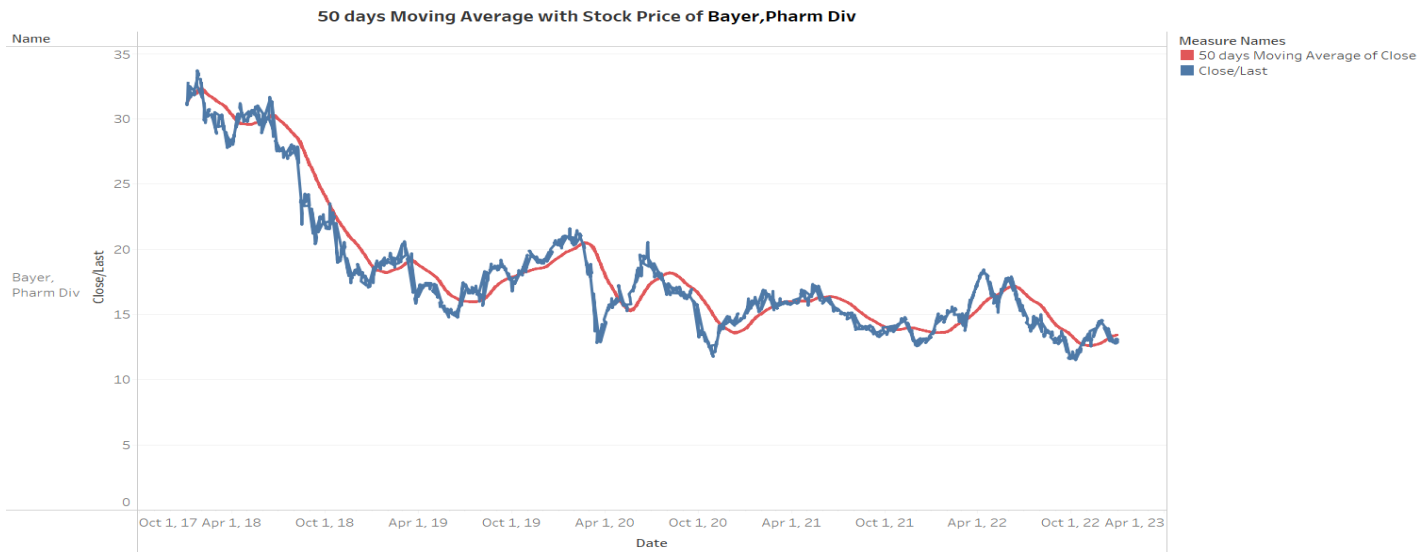
This visualization provides a concise overview of stock performance dynamics, highlighting stability and volatility trends across different pharmaceutical companies.



The plots of Close/Last and 50 days Moving Average of Close for Date broken down by Name on page December 25, 2022. Color shows details about Close/Last and 50 days Moving Average of Close. The view is filtered on Name, which keeps Abbvie US LLC.



The plots of Close/Last and 50 days Moving Average of Close for Date broken down by Name on page December 25, 2022. Color shows details about Close/Last and 50 days Moving Average of Close. The view is filtered on Name, which keeps Bausch Health U.

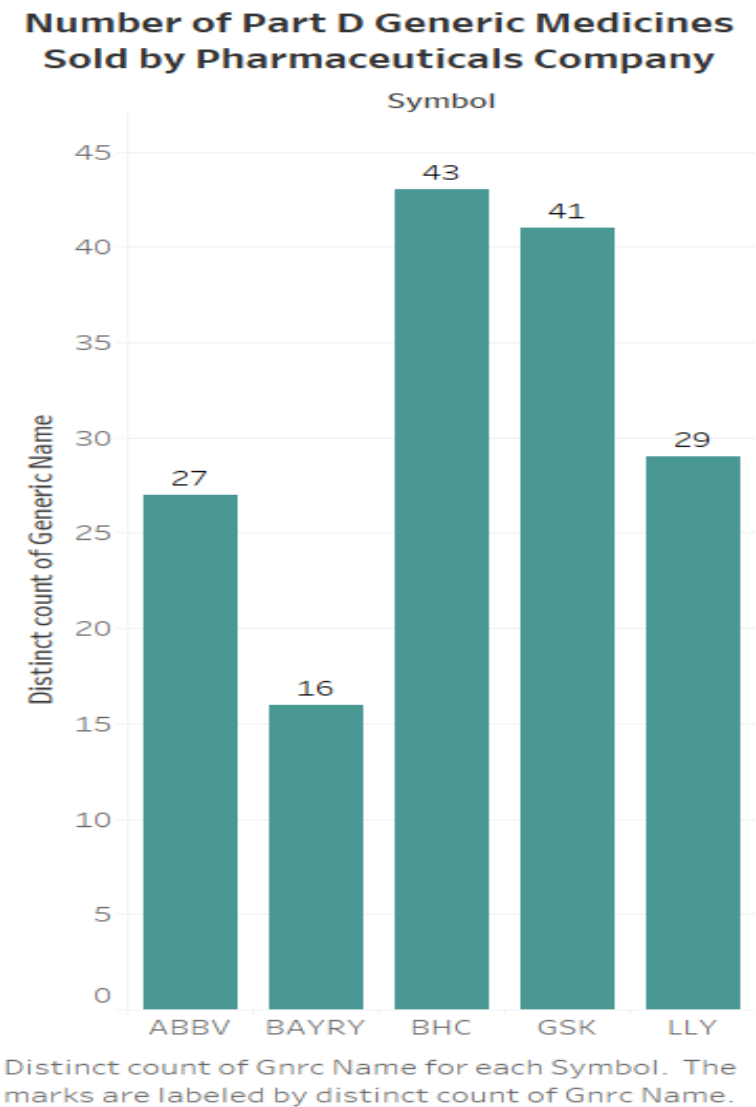


Visualization 5: Count of Part D Medicare Generic Medicines

This plot presents the distinct count of generic medicines manufactured by five pharmaceutical companies participating in Medicare Part D. Each company is represented by its stock symbol.

- AbbVie US LLC (ABBV) offers the highest variety of generic medicines among the selected companies, with a count of 27 unique generics covered by Medicare Part D.
- Bayer (BAY) follows with 16 distinct generic medicines, indicating a slightly smaller range compared to AbbVie US LLC.
- Bausch Health U (BHC) boasts the highest count among the companies, with 43 different generics covered under Medicare Part D.
- GlaxoSmithKline (GSK) and Eli Lilly & Co. (LLY) offer similar counts of generic medicines, with 41 and 29 distinct generics respectively.

This visualization underscores the diversity of generic medicines provided by each company, offering insights into their pharmaceutical portfolios and contributions to Medicare Part D coverage.



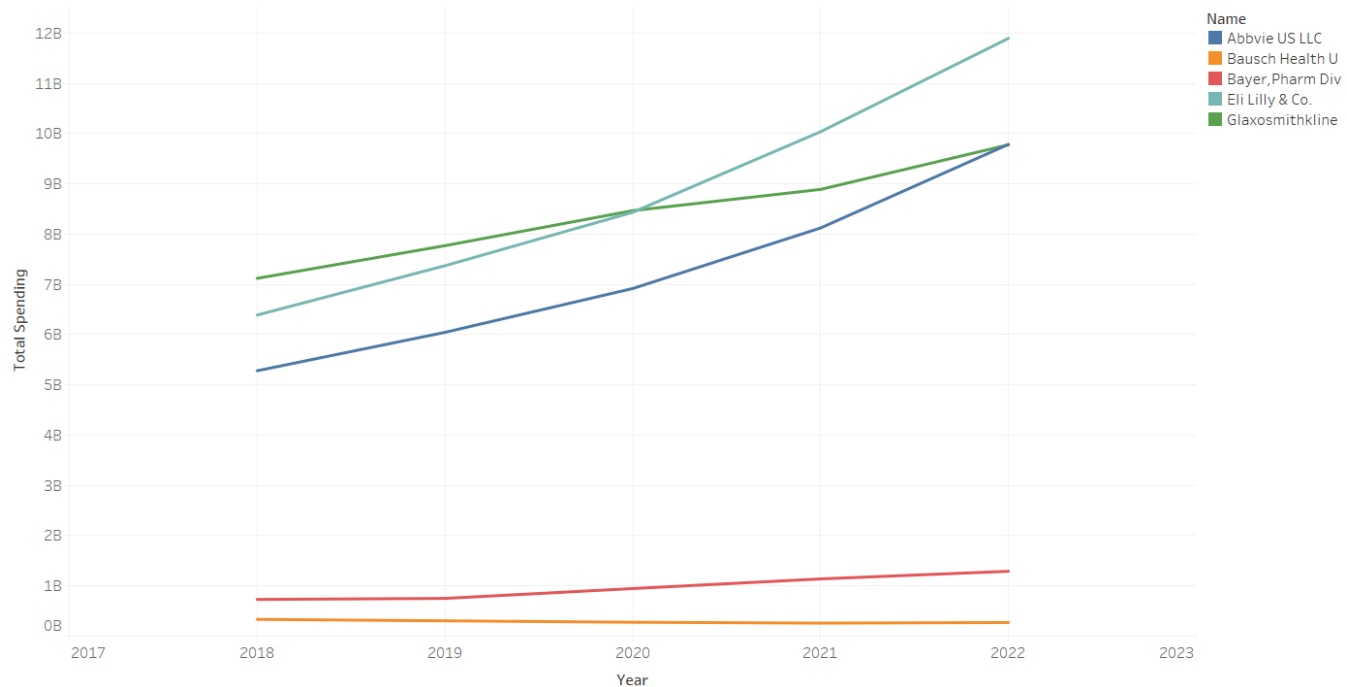
Visualization 6: Total Spending on Medicare Part D Medicines

This plot illustrates the total spending on Medicare Part D medicines over a five-year period for the selected pharmaceutical companies.

- Eli Lilly & Co. (LLY) exhibits a notable growth curve, with spending increasing steadily over the years. The curve experiences a significant surge from 2020 onwards, indicating a sharp rise in spending from \$6 billion to \$12 billion over the five-year period.
- GlaxoSmithKline (GSK) demonstrates relatively less growth compared to Eli Lilly, with spending increasing from \$7 billion to \$9 billion over the same duration. However, the growth appears to slow down, suggesting a potential plateau or declining demand from 2020 onwards.
- AbbVie US LLC (ABBV) reflects a spending trend like Eli Lilly, with expenditure almost doubling from \$5 billion to \$10 billion over the five-year period.
- Bayer's (BAY) spending shows modest growth, increasing from \$0.7 billion to \$1.3 billion, indicating a relatively stable trajectory over the years.
- Bausch Health U (BHC) stands out with spending remaining relatively constant, if not slightly decreasing, from \$0.33 billion to \$0.27 billion over the five-year period, suggesting stability or a decrease in demand for Medicare Part D medicines from this company.

This visualization provides insights into the spending trends of pharmaceutical companies participating in Medicare Part D, highlighting variations in growth trajectories and market dynamics across the industry.

Total Spending on Part D medicines over 5 years for each pharmaceutical company



The trend of sum of Total Spending for Year. Color shows details about Name.

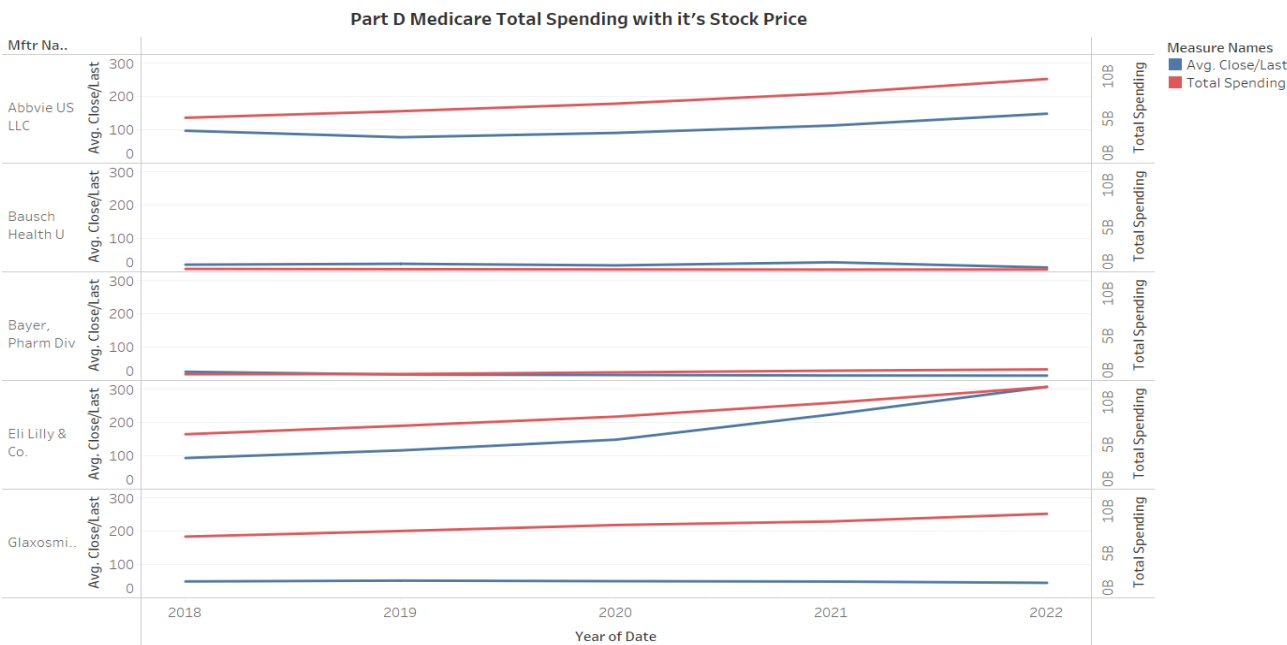
Visualization 7: Stock Performance vs. Medicare Part D Spending

This plot compares the average stock close price of pharmaceutical companies with their total spending on Medicare Part D medicines over a five-year period from 2018 to 2022 to provide a comprehensive understanding of the relationship between stock performance and spending trends.

Insights:

- Eli Lilly & Co. (LLY):** Exhibits a notable uptrend in both stock price and spending on Medicare Part D medicines. The company's strong stock performance aligns with its increasing expenditure, indicating growth and market confidence. The significant surge in spending from 2020 onwards corresponds with the upward trend in stock price, reflecting positive market sentiment and potential growth opportunities.
- AbbVie US LLC (ABBV):** Demonstrates significant improvement in stock performance, particularly evident after April 2020, along with a substantial increase in spending on Medicare Part D medicines. The upward trend in stock price mirrors the growth trajectory in spending, indicating positive market perception and potential revenue growth for the company.
- Bayer, Pharm Div (BAY), GlaxoSmithKline (GSK), and Bausch Health U (BHC):** Show relatively stagnant or declining stock performance, consistent with their spending trends on Medicare Part D medicines. These companies exhibit relatively stable or decreasing expenditure over the five-year period, reflecting market challenges and potentially limited growth opportunities.

Overall, this visualization highlights the varying relationship between stock performance and spending on Medicare Part D medicines for pharmaceutical companies. While some companies experience simultaneous growth in stock price and spending, others face challenges in maintaining market stability and growth.



The trends of Avg. Close/Last and Total Spending for Date Year broken down by Mftr Name. Color shows details about Avg. Close/Last and Total Spending.

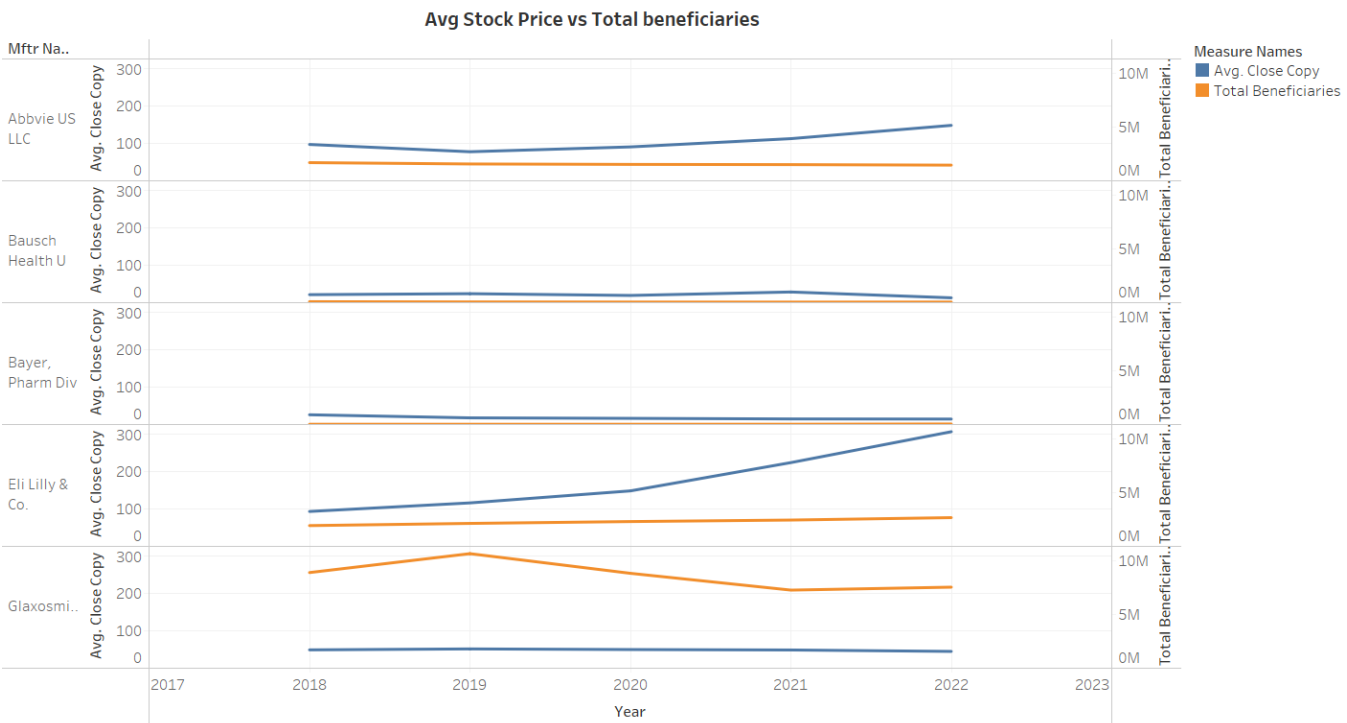
Visualization 8: Stock Close Price vs. Total Beneficiaries Over 5 Years

This plot juxtaposes the average stock close price of pharmaceutical companies with the total number of beneficiaries over a five-year period, providing insights into the relationship between stock performance and beneficiary trends.

Insights:

- Eli Lilly & Co. (LLY): Eli Lilly exhibits exceptional stock performance with a notable uptrend in the closing price over the five-year period, the beneficiary count increases steadily over time, suggesting sustained demand for their products.
- AbbVie US LLC (ABBV): AbbVie's stock performance experiences minor fluctuations, but the total number of beneficiaries witnesses a slight decrease.
- Bausch Health U (BHC): Bausch Health U shows declining stock performance alongside a significant decrease in the total number of beneficiaries.
- GlaxoSmithKline (GSK): GlaxoSmithKline also experiences declining stock performance and a decrease in the total number of beneficiaries.
- Bayer, Pharm Div (BAY): Despite fluctuations, Bayer sees an increase in the total number of beneficiaries.

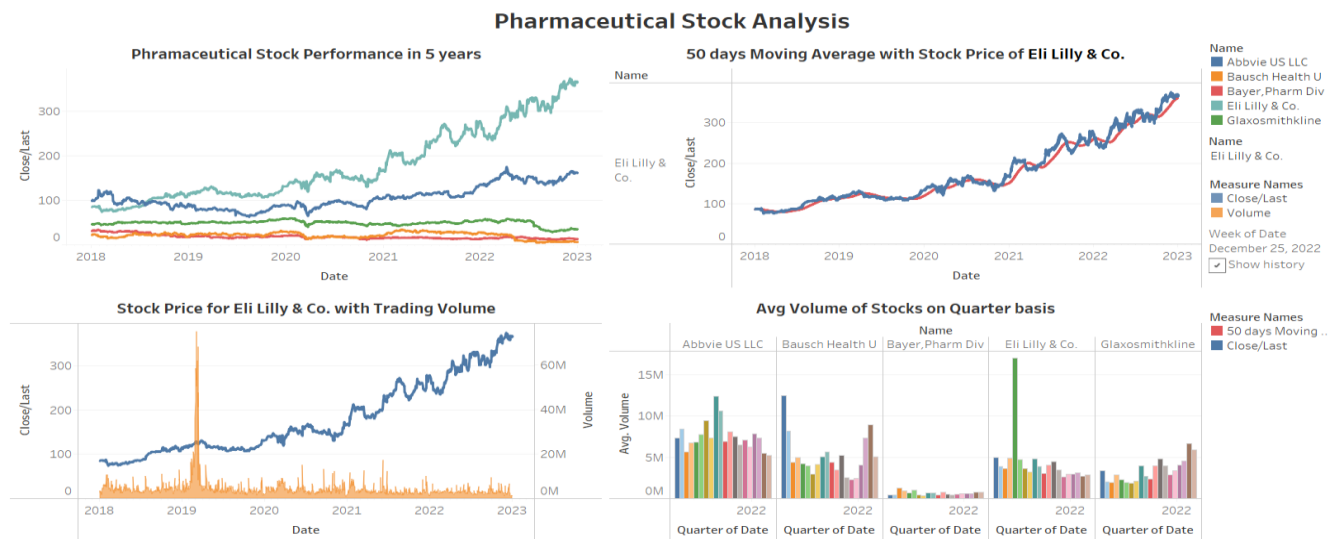
The correlation between stock performance and beneficiary trends is not straightforward.



The trends of Avg. Close Copy and Total Beneficiaries for Year broken down by Mfrtr Name. Color shows details about Avg. Close Copy and Total Beneficiaries.

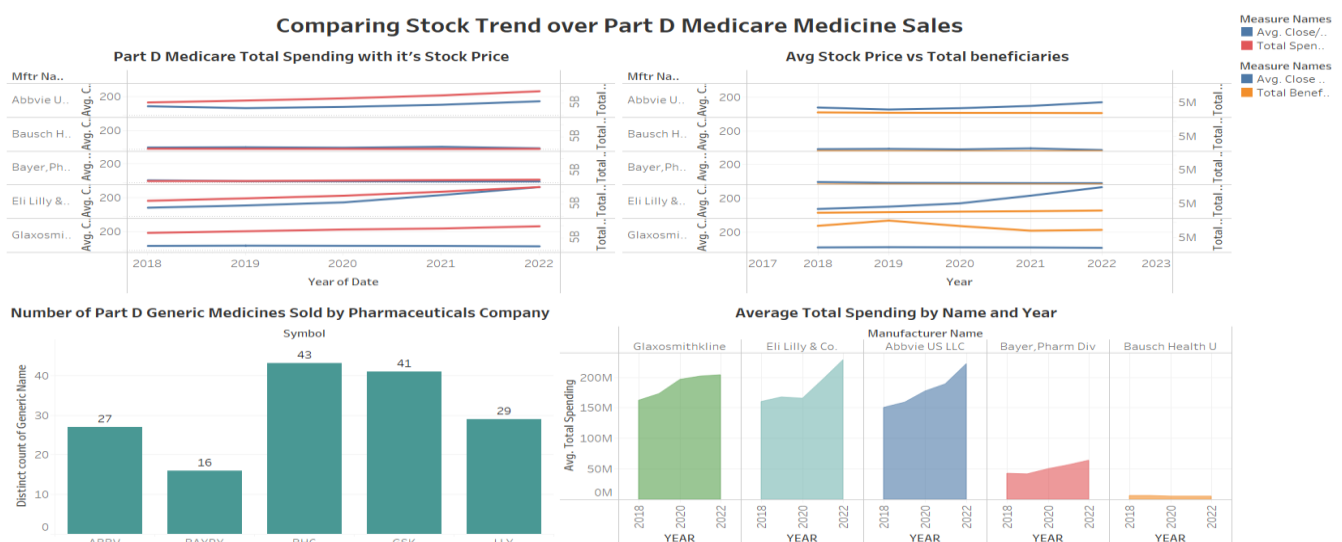
Dashboard 1: Stock Analysis

This dashboard serves as a comprehensive tool for analyzing pharmaceutical stock performance from 2018 to 2022. It offers insights into the trends and dynamics of stock prices for AbbVie US LLC, GlaxoSmithKline, Eli Lilly & Co., Bayer Pharmaceutical Division, and Bausch Health U. By visualizing key metrics such as close prices, moving averages, trading volumes, and trading patterns, this dashboard enables stakeholders to gain a deeper understanding of the financial performance and market sentiment surrounding these pharmaceutical companies.



Dashboard 2: Stock Trend & Medicare Part D Spending

The second dashboard focuses on analyzing the relationship between stock trends and Medicare Part D spending data. It provides insights into how stock performance correlates with healthcare spending trends over the five-year period. By juxtaposing stock metrics with Medicare Part D spending metrics, this dashboard facilitates the identification of patterns, correlations, and potential market dynamics affecting pharmaceutical companies' financial performance and their impact on healthcare spending.



Conclusion

In conclusion, the analysis of pharmaceutical stock prices and healthcare spending trends from 2018 to 2022 has provided valuable insights into the dynamics of the industry. The findings reveal diverse performance among the selected companies, with notable uptrends observed in Eli Lilly & Co. and AbbVie US LLC, while others experienced varying degrees of stability or decline. These trends underscore the complexities of the pharmaceutical market and highlight the importance of understanding individual company dynamics.

Furthermore, the correlations observed between stock performance and Medicare Part D spending trends offer intriguing insights into the interplay between financial markets and healthcare expenditures. The simultaneous growth in stock prices and healthcare spending for some companies suggests potential alignment between financial performance and healthcare demand. However, caution is warranted in generalizing these findings, as the dataset comprises only five companies. A larger data set encompassing a broader range of pharmaceutical firms would provide a more comprehensive understanding of industry trends.

Moving forward, several additional research questions emerge from this analysis:

1. How do external factors such as regulatory changes, market competition, and healthcare policies impact pharmaceutical stock performance and healthcare spending trends?
2. What are the long-term implications of the observed correlations between stock performance and healthcare expenditure on the financial stability and growth prospects of pharmaceutical companies?
3. Are there specific therapeutic areas or drug categories within the pharmaceutical industry that exhibit stronger correlations between stock performance and healthcare spending trends?
4. How do global events, such as pandemics or economic downturns, influence investor sentiment and healthcare spending behaviors within the pharmaceutical sector?

These additional research questions provide avenues for further exploration and deeper understanding of the complex dynamics within the pharmaceutical industry and its intersection with financial markets and healthcare systems. By addressing these questions, future studies can contribute to informed decision-making and strategic planning for stakeholders across the pharmaceutical value chain.