Investigating the Relationship Between Federal Funds Rate and Market Crash Risk

Ha Truong Minh Pham

Commonwealth Honors College, University of Massachusetts Amherst

HONORS499DM: Uncertainty, Risk, Decision

Professor Hossein Pishro-Nik

May 15th, 2024

Abstract

This research investigates the impact of changing interest rates in a range of market sectors to see how interest rates create the potential of a crash in a given market. The sectors analyzed included the S&P 500, NASDAQ Composite, and Dow Jones Industrial Average, as well as crude oil prices, the dollar index, the gold index, and commodity index futures. Each was examined using time series tables generated by Python, and the level of crash risk was determined by the rate of decline in market performance. For stock indices, analyses show that rising interest rates typically cause declines in performance, and stable or falling interest rates generally lead to stock market gains by stimulating investment and consumer spending. A stable interest rate environment appears to be the most favorable condition for stock indices, which is expected because a stable environment can facilitate long-term and predictable strategic financial planning and economic growth. In addition, interest rates affect oil prices, the dollar index, the gold index, and the commodity index, but not directly, as some external factors play a critical role in determining the value of those goods. This study aims to help investors and policymakers predict the impact of interest rates and adjust them accordingly for sustainable economic development.

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Introduction

This honors thesis investigates the connection between interest rates and the risk of stock price crashes. This connection is central in analyzing recent real-world events, such as the collapse of Silicon Valley Bank (SVB).

The downfall of Silicon Valley Bank was primarily triggered by the Federal Reserve's decision to increase interest rates in 2022, which led to a rapid devaluation of the bank's investments in US Treasury bonds and other mortgage securities (Gobler, 2023). Additionally, SVB's unique approach to dealing with high-risk startups and its lack of short-term liquidity assets forced the bank to rapidly sell its assets at a loss. This caused the bank to endure significant losses until finally, on March 8, 2023, it announced that it would have to raise $1.75 billion in capital to stabilize its business activities. This announcement signaled to the public that the bank was in trouble, making corporate customers hasten to withdraw their funds. This mass withdrawal precipitated a rapid 60% plunge in its stock value as its assets rapidly decreased. From all those actions, the bank collapsed within 48 hours of the asset sale disclosure (Early, 2023).

The effect of Silicon Valley Bank's failure spread through the stock market, setting off a chain of value decreases in other financial services. For instance, the S&P 500 dropped by 4.5% over that week, which was the most acute drop of the year. Similarly, banking counterparts such as Western Alliance Bancorp and Signature Bank in New York also experienced dramatic declines in their stock prices, dropping by 20% and 23%, respectively. The KBW bank index, which tracks 24 major banks, also saw consistent declines throughout the week, culminating in a total loss of over 15% (Rennison, 2023).

Observing the serious impacts of these events on the economy, this research aims to discover the relationship between interest rates and the likelihood of stock price crashes by examining the effect of interest rates on market performance. By understanding how interest rate fluctuations influence the chances of significant drops in stock indices, this study seeks to describe the practical implications of inevitable volatility in today's rapidly changing economic landscape. To get a broad picture of the market, this study considers large stock indices, including the S&P 500, NASDAQ Composite, and Dow Jones Industrial Average, alongside crude oil prices, the dollar index, gold index, and commodity index futures. It provides actionable insights for financial institutions and private investors, empowering them with the knowledge to navigate and mitigate the risks associated with stock price crashes. These findings will fill a crucial gap in the current macro-level understanding of financial markets and thus contribute to more informed decision-making processes, enhanced risk management strategies, and the development of policies that ensure economic resilience against future crises.

Literature Review

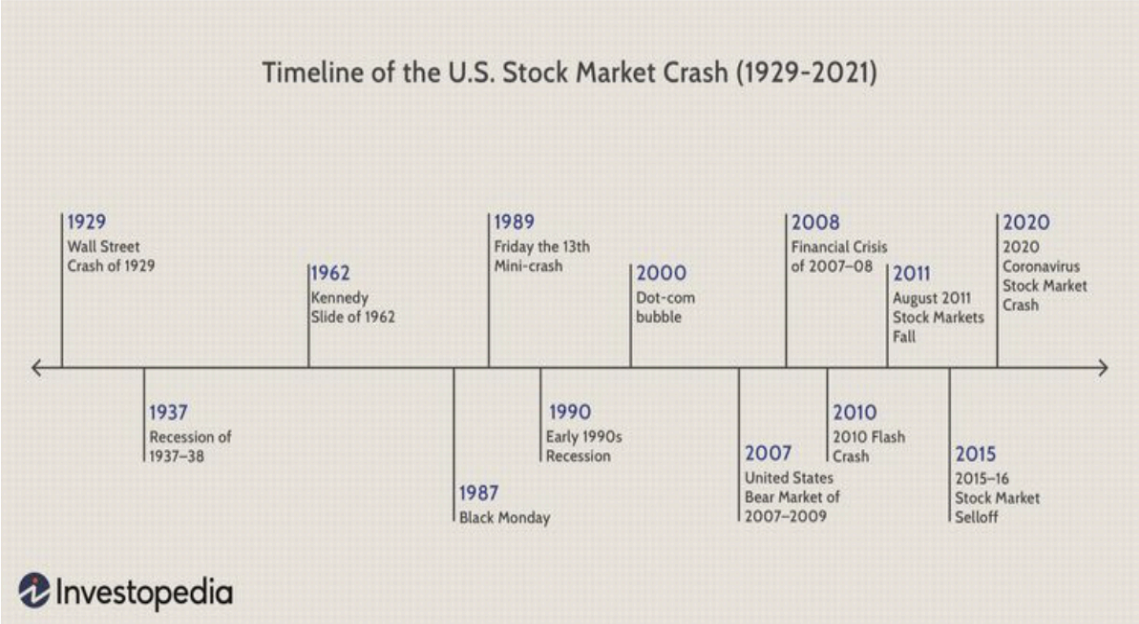
1. What is market crash risk

A crash refers to a sudden and considerable decline in market value in any market over a few days, such as the bonds market or commodity markets, which can immediately lead to an economic recession or depression. However, it typically happens in the stock market. While there's no precise threshold for defining a stock market crash, it's generally considered a double-digit percentage decrease in a stock index in just over a few days. These crashes can be triggered by various significant factors, including catastrophic events, economic depressions, or the collapse of long-term speculative bubbles. During a crash, investors may rapidly sell assets in

a panic to gain as much profit as they can before the market declines further or to handle over-leveraged investments (Chen, 2021).

In the United States, a crash is typically marked by a sharp decline in key market indexes, including the Dow Jones Industrial Average (DJIA), the Standard and Poor's 500 (S&P 500), and the Nasdaq Composite. Stock price crashes can have a systemic impact, which can affect other market areas. For instance, investors facing stock market losses may sell other securities, potentially triggering a decrease in asset prices altogether. This can then lead to a bear market, further impacting the economy in the long term, a gradual drop over months or years (Kenton, 2021).

To mitigate the effects of crashes, many stock markets have implemented circuit breakers. These mechanisms can halt trading if declines breach certain thresholds, providing a temporary pause in trading. This delay allows market participants to re-evaluate their positions and potentially prevent further panic selling. Thus, this can eliminate a crash in the market (Chen, 2021).



Source: Sabrina Jiang © Investopedia 2021

2. Causes of crash risk

a. Financial reporting and corporate disclosure

The theoretical foundation of crash risk aligns with the agency theoretic framework, indicating that information asymmetries between corporate insiders and external stakeholders can lead to crash risk. This theory suggests that managers may hide negative information to maximize compensation and minimize legal concerns. When executives conceal and accumulate negative information without developing effective solutions, it can precipitate a financial crash within the company and lead to a market crash. In a low-interest-rate environment, managers can alleviate some financial concerns as they have a lower cost of borrowing and investment, which can help the company boost its revenue through business activities and have enough financial resources to compensate for the loss in business activities. However, the risk may increase with rising interest rates. As managers face increasing borrowing costs and other profitability

challenges, they may be inclined to hide information to stabilize their companies, thereby heightening the likelihood of a crash (Jin & Myers, 2006).

Additionally, research indicates that firms with higher default risk are more likely to release disadvantageous news, contributing to crash risk. As companies face a higher probability of default, they tend to announce either exceptionally positive or negative news. This tendency arises from their unstable position, where they are on the brink of either collapsing or maintaining normal operations (Hutton et al., 2009). While it is understandable that a highly leveraged company has a higher probability of crashing, surprisingly, there is a negative association between them. One possible explanation for this relationship is that highly leveraged firms are usually underpriced, making them less likely to experience crash risk (Campbell et al., 2008).

An alternative theory, known as the 'information blockage' model (Cao et al., 2002), suggests that traders' lack of transparency also contributes to crash risk'. This model states that traders with more information about the price trend may actively engage in trading, while less informed traders may delay their strategies until a safer time. For instance, if traders anticipate an increase in interest rates during the next Federal Reserve meeting, which would decrease the company's stock prices, informed traders might decide to short stocks of certain companies simultaneously, leading to a crash risk for those companies. This model highlights the role of information asymmetry in market dynamics and its potential impact on crash risk.

In summary, the impact of information imbalances between insiders and outsiders in a company is an essential factor in causing crash risk in the market. Therefore, it is necessary to

maintain transparency, strong risk management practices, and effective oversight to reduce the likelihood of such events and maintain a stable financial market.

b. Managerial incentives and managerial characteristics

Managerial incentives play a significant role in catalyzing crash risk in financial markets, as they influence the behavior and decisions of top executives. Examining the compensation incentives of the entire top management team could provide further insights into crash risk, as the top management team may act as an internal governance mechanism, potentially mitigating or heightening the risks associated with their business activities (Kim et al., 2011a).

For example, compensation incentives such as stock options and inside debt can affect the behaviors of chief financial officers (CFOs). These incentives encourage CFOs to manipulate information provided to the market to maximize their compensation through higher stock prices and enhanced business revenue, potentially leading to increased financial instability and crash risk in a business. Conversely, chief executive officers (CEOs) with higher inside debt, such as pensions and deferred compensation, have more incentive to mitigate company distress risk. Since these forms of compensation depend on the company's continued success and solvency, CEOs are typically more focused on the company's long-term health, thus decreasing future crash risk associated with the company and other businesses related to the company's activity (He, 2015).

There is also an association between CEO overconfidence and stock price crash risk. CEOs' overconfidence is linked to higher stock price crash risk in a company because overconfident managers tend to overestimate investment returns and ignore considerable negative feedback on projects (Kim et al., 2016a). For companies with conservative accounting

policies, the impact of CEOs' overconfidence on crash risk appears less critical. This is because conservative accounting policies recognize expenses and losses earlier, resulting in lower reported earnings and asset values, which may make CEOs more cautious with their risk to maintain the company's financial situation. Therefore, thorough management in accounting helps mitigate potentially dangerous decisions that overconfident CEOs might make and reduces the likelihood of a crash. In addition, when firms use conservative accounting policies, the company's financial health is more transparent, which helps investors assess the risk and economic situation better, boosting investors' confidence and making the company less vulnerable to crash risk (Kim et al., 2016a).

An example of crash risk related to a CEO's overconfidence is Gregory Becker, CEO of Silicon Valley Bank, who was highly optimistic about the Bank's perspective on the future of the tech industry and the Bank's pivotal role and potential earnings within it. Nevertheless, this confidence was challenged when Moody's, the rating agency, administered a warning about the Bank's financial stability and the potential risk of its bonds being downgraded to junk status. This alarm caused considerable concerns at Silicon Valley Bank, and the Bank was compelled to announce an emergency plan to raise $2.25 billion in new capital in response to the crisis. The sudden announcement astounded depositors and investors, making them immediately withdraw $40 billion from their accounts, resulting in a dramatic 60% decline in the Bank's stock value in just one day (Farrell, 2023).

c. Corporate governance and crash risk

The effectiveness of the mechanisms in reducing crash risk is critical, and it is greatly dependent on the quality of internal controls within an organization. The longer tenure of

auditors not only enhances their familiarity with clients' specific circumstances but also reassures the system's effectiveness in detecting and preventing client activities that may lead to crash risk (Callen & Fang, 2013). The activity level and financial expertise among board and audit committee members significantly limit managerial tendencies toward earnings manipulation to meet specific financial goals (Xie et al., 2003). For instance, a substantial presence of independent directors on the audit committee, sufficient industry expertise among auditors, and a well-defined corporate governance framework can decrease the probability of a crash due to financial manipulation. In contrast, companies with inadequate internal control over financial reporting tend to release less trustworthy financial information, often resulting from accruals manipulation, which is a key factor driving crash risk (Andreou et al., 2016).

d. Political connections and crash risk

The impact of political connections on stakeholder interests remains controversial, with conflicting evidence regarding their effects. Fisman (2001) found evidence that supports the beneficial aspects of political connections, suggesting they enhance firms' value and offer various advantages. These connections might provide firms with privileged access to information and regulatory decisions, as well as financial advantages such as subsidies, all of which can boost a company's financial and operational efficiency. However, other studies indicate that political connections can harm minority interests, as research shows that politically connected firms often engage in rent-seeking activities, such as tunneling, which can harm stakeholders and lead to crash risk (Boubakri et al., 2012).

Therefore, while political connections can open doors and create opportunities for growth for companies, they also carry risks that can negatively affect a company. Thus, it is necessary to carefully examine the advantages and drawbacks of political engagement in the business world.

e. Religion

Another informal institution that has implications for crash risk is religion. Callen and Fang (2015b) discovered that US firms which are based in locations that have higher levels of religiosity tend to have lower crash risk. This finding points to the moral and ethical guidelines often emphasized in religious communities, which naturally discourage unethical behavior among managers. In such environments, the social norms influenced by religion might deter executives from withholding negative information or manipulating financial data for personal gain. In addition, firms in regions with high social trust have smaller crash risks (Li et al., 2017), suggesting that social trust and formal institutional monitoring mechanisms are partially interchangeable (Cao et al., 2016). In areas with high trust, there might be less need for strict regulations or oversight, as the community's own standards and expectations help ensure good corporate governance.

Overall, these findings illuminate how informal institutions like religion and social trust not only shape corporate behavior but also create a buffer against financial instability. They foster an environment where unethical practices are discouraged and transparency is valued, thus contributing to overall lower crash risks. This underscores the importance of considering both formal and informal institutions in assessing financial risks and the health of business environments.

f. Short sellers and crash risk

A study conducted on a diverse sample of U.S. public firms suggests a direct link between short sellers, individuals who profit from a stock's price decline, and the likelihood of stock price crashes over one year. The findings provide compelling evidence that short sellers can predict stock price crashes because they are adept at detecting signals where corporate

management conceals negative news. A critical element that enhances the effectiveness of short sellers is the presence of weak governance within particular firms because these companies typically exhibit inadequate internal controls and a lack of transparency, which is particularly noticeable during earnings calls and financial disclosures. Such environments create fertile ground for short sellers, who do more than simply respond to the publicly available information. They conduct thorough analyses of the companies, which often lead them to uncover obscured or misleading financial data that suggests an underlying instability in a company's financial position. Furthermore, this study also speaks to the systemic issues within firms that fail to maintain robust governance frameworks, which can jeopardize the firm's financial health and pose broader market risks (Callen & Fang, 2015). Accordingly, this study not only underscores the predictive power of short selling in forecasting stock price crashes but also highlights the need for more substantial governance structures to enhance market stability and transparency.

g. Private debt contracts

The study conducted by Gu et al. (2019) offers an analysis of the relationship between anticipated stock price crashes and bank loan pricing in the context of China's financial landscape. Through their meticulous examination of Chinese data, the researchers reveal that companies facing a higher expected crash risk tend to encounter heightened borrowing costs because banks adjust their interest rates based on the perceived crash risk of borrowing entities. Furthermore, the study uncovers a positive correlation between the anticipated risk of stock price crashes and the interest spread on bank loans. As the likelihood of a stock price crash increases, banks widen their interest rate spreads, thereby reflecting a higher risk premium. Additionally, the researchers observed that during periods of heightened crash risk, Chinese banks tend to offer

loans with shorter maturity periods as an adjustment to aligning loan durations with the perceived volatility in stock prices and managing credit risk (Gu et al., 2019).

These significant findings lay the groundwork for comprehending the dynamic nature of bank loan pricing in response to stock market dynamics in China. They emphasize the crucial role of incorporating market expectations and risk perceptions into banking practices and loan pricing strategies to navigate the intricacies of the financial landscape, especially during periods of heightened market uncertainty.

h. Access to information

Intriguingly, investors' access to information is closely linked to the potential risk of stock crashes. For instance, the withdrawal of Google's search services from China limited investors' ability to gather information online. As a result, the stock price crash risk for companies that were more frequently searched on Google before its withdrawal increased by 19%, indicating that online searches aid investors in processing information. Additionally, the sensitivity of stock returns to negative posts on the internet rose by 36%. This heightened risk of crashes is particularly evident for firms more inclined to conceal adverse information and when information intermediaries are less effective in aiding investors' information processing. Despite the emergence of Baidu as a dominant search engine in China after Google's departure, concerns exist regarding the reliability of the information it provides, given its reputation for manipulating search results (Xu et al., 2021).

This research suggests that companies with a significant number of individual investors are more inclined to experience crashes, as these investors rely heavily on access to information. Therefore, when crucial information is lacking, like in the case of Google's withdrawal, individual investors lose interest and awareness in the affected companies, discouraging them

from closely monitoring these firms and ultimately increasing the risk of a crash. Additionally, when investors feel they need more access to information, they become hesitant to engage in trading activities, further impacting market dynamics.

3. Interest rate and stock return

The study by Reilly and colleagues (2017) provides valuable insights into the relationship between changes in interest rates and stock returns by investigating the impact of interest rates on common stocks. The concept of duration, which is typically used in the context of fixed-income securities, is used to measure the sensitivity of a stock's price to changes in interest rates. According to the study, there is a negative relationship between market beta and equity duration. Industries with low market betas tend to have high equity durations, which leads to a higher sensitivity to interest rate changes. Conversely, industries with high market betas exhibit low or negative equity durations, suggesting lower interest rate risk (Reilly et al., 2017).

These findings underscore the importance of taking interest rate changes into account when evaluating equity securities, as these changes can have a considerable impact on stock returns. For investors and analysts aiming to make informed decisions in the stock market, it is essential to grasp the dynamics of interest rate sensitivity across various industries and market segments.

Each research article discussed in this study offers a unique and valuable perspective, collectively enriching our understanding of crash risk dynamics within financial markets. By exploring a wide range of aspects of crash risk, from the role of corporate governance mechanisms to the impact of short-interest and interest-rate fluctuations, these studies provide a diverse and intriguing array of viewpoints on the complex factors that shape market stability and investor behavior.

Explanation of Current Methodology and Goals

In this thesis, I will examine the relationship between interest rates and the risk of specific types of market crashes, such as stock market crashes and commodity market crashes. I will do this by examining the market performance of stock indices and essential commodities. Below is a detail of the methodology and goals guiding my research:

Current Methodology:

Data Collection: I collected a wide range of data from January 1, 2000, to January 1, 2024. By covering more than two decades, this dataset can capture the short-term fluctuations and seasonal patterns in financial markets and provide enough data to explore long-term trends and the broader economic impacts of monetary policy changes. This ensures that my analysis can study the effects of interest rates on market crash risks across different economic conditions, enhancing the reliability and validity of my results.

My datasets include the Fed Fund Effective Rates, which I collected from the Federal Reserve Economic Data (FRED). In addition, I also collected data from major stock indices like the Standard and Poor's 500 (S&P 500), Dow Jones Industrial Average (Dow Jones), and the Nasdaq Composite, which I access through Yahoo Finance. Each of these indices offers a unique perspective on the market: the S&P 500 provides an overall picture of the stock performance of 500 of the biggest companies listed on stock exchanges in the United States; the Dow Jones includes 30 prominent companies listed on stock exchanges in the United States; and the Nasdaq includes more than 3700 stocks lists on the Nasdaq stock exchange, to deepen my analysis.

In addition, I will also analyze other critical economic indicators like crude oil prices, the dollar index, the gold index, and commodity futures. These indicators are crucial as they provide insights into how interest rates affect these vital commodities. To further broaden my research, I

will also examine the Standard & Poor's Goldman Sachs Commodity Index (S&P-GSCI), a composite index of the commodity sector. This will help me understand commodity price movements, speculation, and hedging through futures contracts, thereby diversifying my analysis.

Analytical Tools:

I use Python and its libraries, such as Pandas and Matplotlib, to process data, manipulate and visualize data, and conduct statistical analysis. Using Python, I will conduct time series analysis to track how fluctuations in interest rates correlate with movements in stock indices and commodity prices and identify anomalies or outliers in the data.

Firstly, I integrated a Yahoo Finance function to retrieve data directly, which helps to ensure accuracy and validity while eliminating errors in the download process. Additionally, I imported essential libraries such as pandas and matplotlib to facilitate the creation of time series plots later on.

```
!pip install yfinance
import pandas as pd
import matplotlib.pyplot as plt
import statsmodels.api as sm
```

I then used the yfinance library to retrieve the historical data for the S&P 500 index, which is represented by the ticker symbol ^GSPC, using the yf.download function. As I wanted to collect data for the period from January 1, 2000, to January 1, 2024, I specifically chose that range. After gathering the data, I used print(sp500_data.tail()) to display the last few rows of the data frame to observe the most recent data points for the S&P 500 index to ensure my data was in the correct format.

```
import yfinance as yf

# Define the ticker symbol
sp500 = '^GSPC'

# Fetch the data
sp500_data = yf.download(sp500, start='2000-01-01', end='2024-01-01')

# Print the first few rows of the dataframe
print(sp500_data.tail())
```

```
[**********100%%**********]  1 of 1 completed
```

Date	Open	High	Low	Close	Adj Close
2023-12-22	4753.919922	4772.939941	4736.770020	4754.629883	4754.629883
2023-12-26	4758.859863	4784.720215	4758.450195	4774.750000	4774.750000
2023-12-27	4773.450195	4785.390137	4768.899902	4781.580078	4781.580078
2023-12-28	4786.439941	4793.299805	4780.979980	4783.350098	4783.350098
2023-12-29	4782.879883	4788.430176	4751.990234	4769.830078	4769.830078

After obtaining the data for the S&P 500 index, I imported the Federal Fund Effective Rates from the dataset I downloaded from the Federal Reserve Economic Data (FRED) by reading the CSV file containing the interest rate data and storing it in a data frame named interest_rate. This allowed me to easily manipulate and analyze the interest rate data alongside the stock market data.

```
interest_rate = pd.read_csv('FEDFUNDS.csv')
interest_rate
```

	DATE	FEDFUNDS
0	1954-07-01	0.80
1	1954-08-01	1.22
2	1954-09-01	1.07
3	1954-10-01	0.85
4	1954-11-01	0.83
...	...	...
831	2023-10-01	5.33
832	2023-11-01	5.33
833	2023-12-01	5.33
834	2024-01-01	5.33
835	2024-02-01	5.33

After that, I manipulated the interest rate data obtained from the Federal Reserve Economic Data (FRED) to best fit my intention. First, I converted the 'DATE' column to datetime format using pd.to_datetime() to ensure that the dates are properly recognized by pandas. Next, I filtered the data based on a specified date range, which is from January 1, 2000, to January 1, 2024, using boolean indexing. This step created a new data frame called interest_rate_data containing only the rows that fall within the specified date range. Finally, I use print(interest_rate_data.tail()) to display the last few rows of the filtered data frame to make sure I have the correct data set.

```
# Convert the 'DATE' column to datetime
interest_rate['DATE'] = pd.to_datetime(interest_rate['DATE'])

# Filter data based on date range
interest_rate_data = interest_rate[(interest_rate['DATE'] >= '2000-01-01') & (interest_rate['DATE'] <= '2024-01-01')

# Display the first few rows of the filtered dataframe
print(interest_rate_data.tail())
```

```
          DATE  FEDFUNDS
830 2023-09-01      5.33
831 2023-10-01      5.33
832 2023-11-01      5.33
833 2023-12-01      5.33
834 2024-01-01      5.33
```

I wanted to create a dual-axis plot to visually compare the Federal Funds Rate (interest rate) and the S&P 500. By plotting these two datasets on the same graph with different y-axes, I would easily see if there are any correlations or patterns between changes in the interest rate and the performance of the stock market index. This visualization can help me analyze how changes in interest rates might impact stock market performance and vice versa.

To create a dual-axis plot comparing the Federal Funds Rate (interest rate) and the S&P 500 index, I used matplotlib. First, I created a figure and axis object with plt.subplots(). Then, I plotted the Federal Funds Rate data on the left y-axis (ax1) using ax1.plot(), specifying the date on the x-axis and the interest rate on the y-axis. I labeled and set the blue color for the interest rate. Next, I created a second y-axis (ax2) using ax1.twinx() to overlay the S&P 500 index data. I plotted the S&P 500 index data on the right y-axis using ax2.plot(). I labeled and set the color red for the S&P 500 on the right y-axis.

```
fig, ax1 = plt.subplots()

# Plot the first dataset on the first y-axis
color = 'tab:blue'
ax1.set_xlabel('Date')
ax1.set_ylabel('Interest Rate (%)', color=color)
ax1.plot(interest_rate_data['DATE'], interest_rate_data['FEDFUNDS'], color=color)
ax1.tick_params(axis='y', labelcolor=color)

# Create a second y-axis and plot the second dataset
ax2 = ax1.twinx()
color = 'tab:red'
ax2.set_ylabel('S&P500', color=color)
ax2.plot(sp500_data['Adj Close'], color=color)
ax2.tick_params(axis='y', labelcolor=color)

# Add a title
plt.title('Interest Rate vs. S&P500')

# Show plot
plt.show()
```

After getting the result that I wanted, I repeated the process of examining the relationship between interest rates and the S&P 500 for other indices and variables, including the NASDAQ Composite and Dow Jones Industrial Average, as well as crude oil prices, the dollar index, the gold index, and commodity index futures. This approach would help me have a better understanding of the impact of interest rates on different sectors of the economy and financial markets.

Goals:

My main objective is to interpret how changes in interest rates can impact different market sectors through time series analysis. This research could identify market instability patterns and predictors, which can help us develop practical risk management strategies to prepare better for and mitigate potential downturns. Additionally, I hope insights from this research could be invaluable for central banks and financial regulators, helping them formulate more effective monetary policies that stabilize markets and promote economic growth.

By combining detailed data analysis with theoretical exploration, my research aims to provide a nuanced understanding of the connections between interest rates and market behavior, offering valuable insights for academic and practical policy regulations.

Report and Discussion of Research Results

A. Relationships between Federal Funds Effective Rate and Percentage Change in Index Stock Prices

1. Relationship between Federal Funds Effective Rate and Percentage Change in the S&P 500 Index

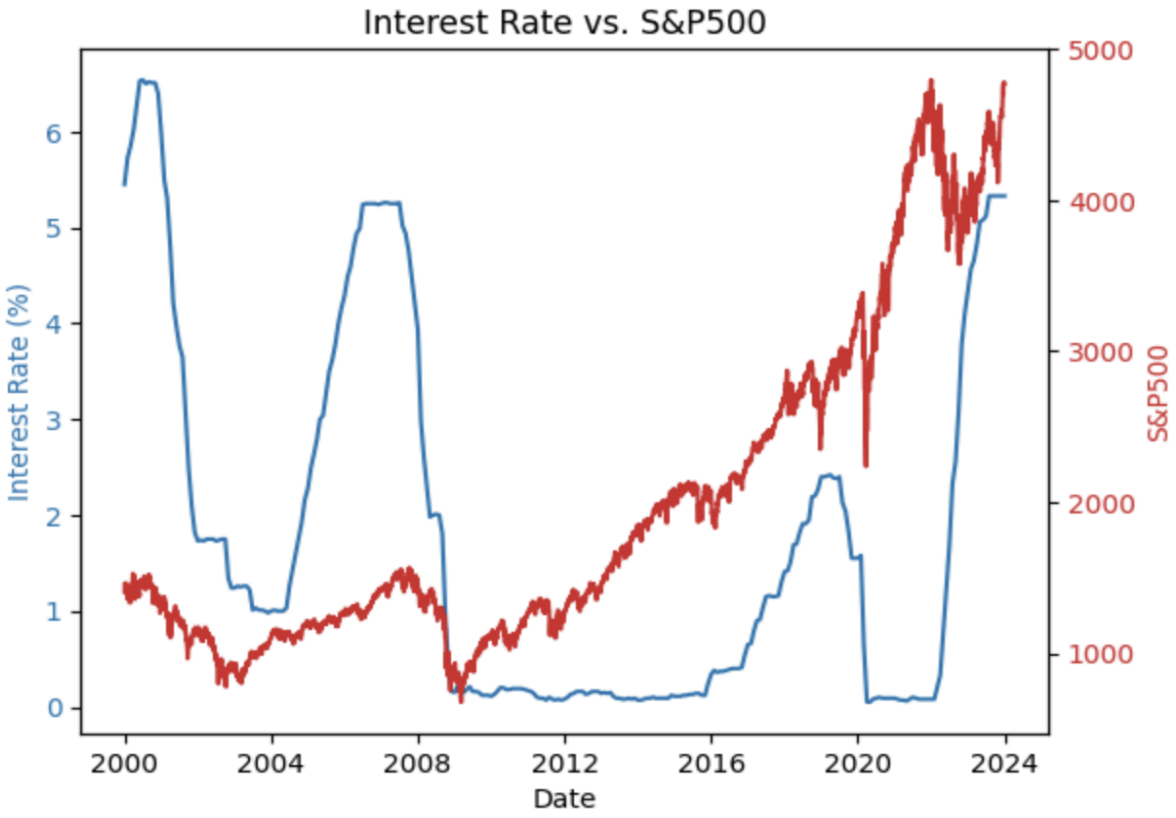


Figure 1: Relationship Between Federal Funds Effective Rate and S&P 500 Index: The Federal Funds Effective Rate Data was collected from the Federal Reserve Economic Data (FRED) and US Dollar Index was collected from Yahoo Finance (1/1/2000-1/1/2024)

Figure 1 shows a tangible inverse relationship between the Federal Funds Effective Rate and the percentage change in the S&P 500 index. As the Federal Funds Effective Rate increases, investors and market participants interpret this as a signal of tighter monetary policy by the Federal Reserve, potentially making them restrain spending and investment activity. The anticipation of this decline exerted downward pressure on stock prices and hence decreased the S&P 500 index.

Consequently, the increase in interest rates from March 17, 2022, to July 26, 2023, from 0.25% to 5.5% by the Federal Reserve had a significant impact on the outlook for economic growth and corporate profitability. Higher interest rates can make borrowing more expensive for companies, directly affecting their earnings growth potential. Additionally, investors reallocate their portfolios away from equities and into other assets offering higher yields, such as bonds, to gain more profit. This adjustment in expectations for future corporate earnings and economic growth led to heightened volatility and downward pressure on stock prices, which led to a decrease in the S&P 500 index of approximately 20% during this period.

On the other hand, when the Federal Funds Effective Rate is lowered or maintained at lower levels, the Federal Reserve often perceives it as a stimulative measure to support economic activity and lending. Investors believe that lower interest rates can incentivize borrowing and investment, stimulating corporate earnings growth and consumer spending, which in turn supports stock market sentiment. Thus, during periods of declining or stable interest rates, the percentage change in the S&P 500 index tends to exhibit an uptrend, indicating a positive correlation between interest rates and S&P 500 performance.

The period from 2013 to 2016 serves as a compelling example of how stability in interest rates can foster robust growth in the S&P 500 index. During this period, the Federal Reserve

maintained a relatively low Federal Funds Effective Rate as part of its accommodative monetary policy perspective. This policy, implemented after the global financial crisis in 2008, acted as a catalyst for market growth. With interest rates at historically low levels, borrowing costs for businesses and consumers remained favorable, encouraging increased investment, expansion, and consumer spending. This, in turn, contributed to strong corporate earnings growth and a remarkable surge in the S&P 500 index, nearly doubling in value over those years.

2. **Relationship between Interest Rate and Percentage Change in the Nasdaq Composite Index**

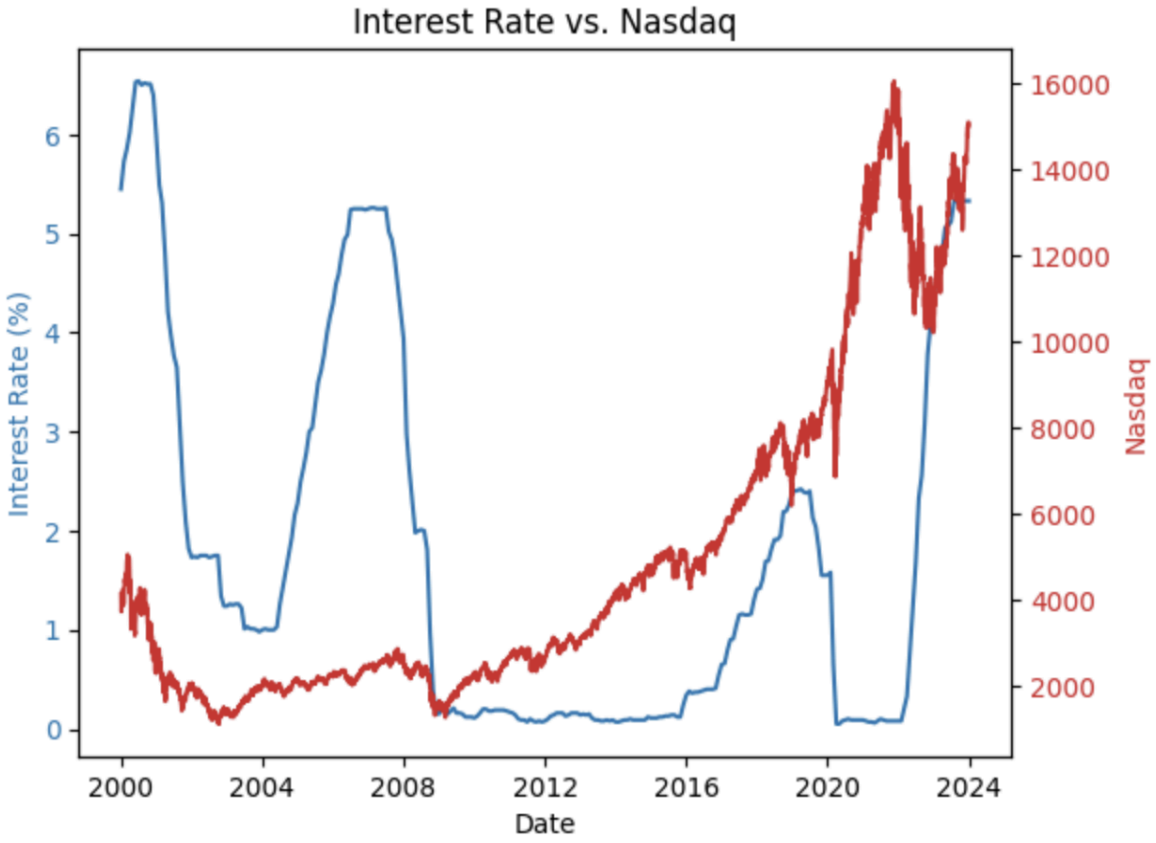


Figure 2: Relationship Between Federal Funds Effective Rate and Nasdaq Index: The Federal Funds Effective Rate Data was collected from the Federal Reserve Economic Data (FRED) and Nasdaq Index was collected from Yahoo Finance (1/1/2000-1/1/2024)

Figure 2 demonstrates that the NASDAQ Composite Index, which concentrates on technology, internet, and high-growth companies, is also subject to the influence of the Federal Funds Effective Rate, as is the S&P 500 index. The graph shows that when the Federal Funds Effective Rate increases, the NASDAQ Composite Index tends to decline, highlighting a negative correlation between interest rates and the performance of technology and high-growth stocks represented in the NASDAQ.

Looking at the period from March 17, 2022, to July 26, 2023, it is reasonable to assume that the NASDAQ Composite Index faced challenges similar to the S&P 500 index. When the Federal Reserve gradually increased the Federal Funds Rate from 0.25% to 5.5%, it resulted in higher borrowing costs for technology companies, potentially slowing down their pace of growth and innovation. As a result, investors approach the market more cautiously and carefully, reassessing their strategies and expectations for future earnings and economic growth. Consequently, the NASDAQ Composite Index experienced downward pressure and declined by approximately 25% during this period.

On the other hand, when interest rates are held at low levels, borrowing costs for businesses remain affordable, encouraging increased investment, expansion, and innovation within the technology sector. Additionally, consumers benefited from lower borrowing costs, which helped enable strong consumer spending and increased demand for technology products and services. Hence, the market stays stable and positive, boosting investor confidence and appetite for technology and high-growth stocks. Thus, during the period from 2013 to 2016, when the Federal Reserve maintained relatively low and stable interest rates, the NASDAQ Composite Index experienced a remarkable surge, nearly doubling in value over the course of

those years, reflecting the significant gains made by companies within the technology and high-growth sectors.

3. **Relationship between Interest Rate and Percentage Change in the Dow Jones Industrial Average**

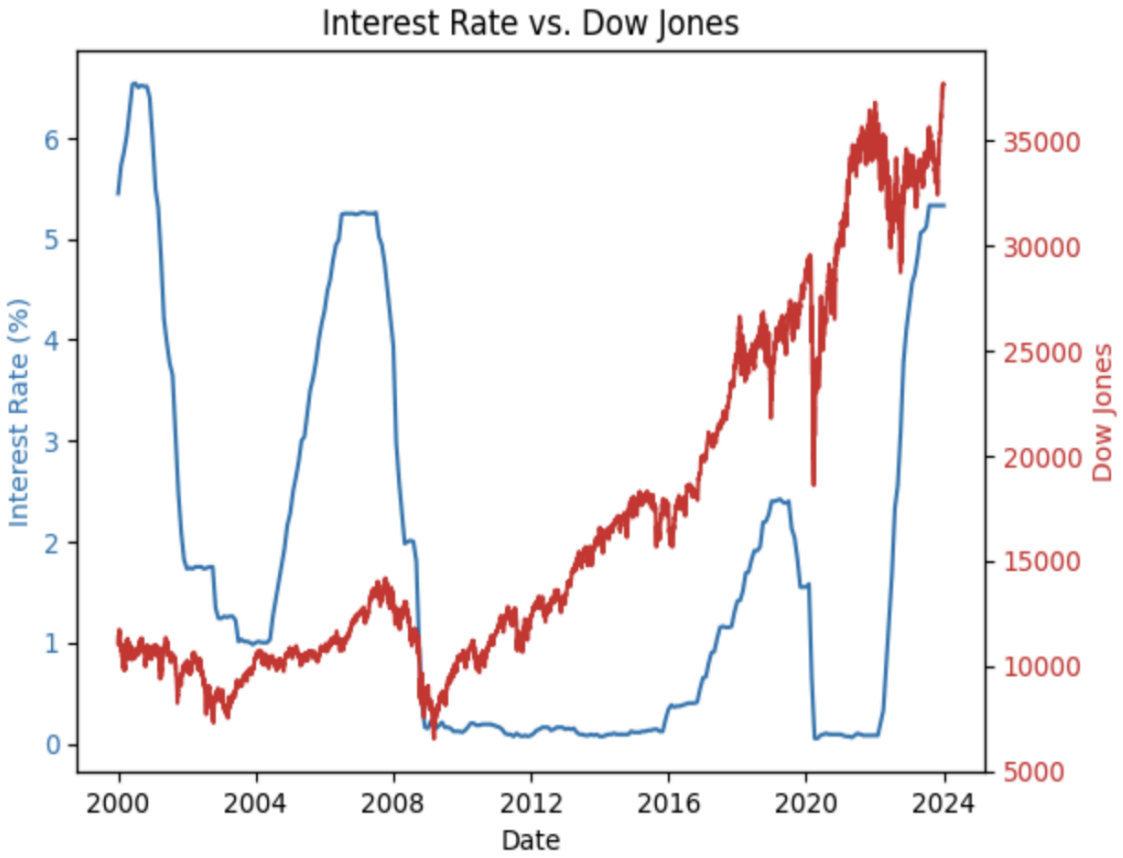


Figure 3: Relationship Between Federal Funds Effective Rate and Dow Jones Index: The Federal Funds Effective Rate Data was collected from the Federal Reserve Economic Data (FRED) and Dow Jones Index was collected from Yahoo Finance (1/1/2000-1/1/2024)

Figure 3 provides a visual illustration of the relationship between interest rates and the Dow Jones Industrial Average, offering valuable insights into the dynamics driving the performance of blue-chip stocks in response to changes in interest rates.

According to Figure 3, the Dow Jones increased by almost 40% between 2013 and 2016. This period corresponded with stable interest rates, during which the Federal Reserve continued implementing accommodating monetary policies following the global financial crisis. The favorable borrowing conditions and strong economic growth during this period reinforced investor confidence, subsequently pushing up stock prices for companies that were included in the Dow Jones index. Even as the Federal Reserve gradually increased interest rates after 2016, the Dow Jones index continued its upward trajectory. This suggests that other factors, such as strong corporate earnings and favorable economic indicators, were able to outweigh the impact of rising interest rates. Importantly, the gradual pace of interest rate hikes allowed investors to adapt to changing monetary conditions without negatively affecting the overall market sentiment.

However, the Dow Jones index experienced a significant decline in 2020 during the COVID-19 pandemic. At this time, in response to the pandemic's impact on the economy, the Federal Reserve swiftly implemented monetary motivation, including lowering interest rates to near-zero levels. This dramatic decrease in interest rates initially contributed to a recovery in stock prices. However, the uncertainty surrounding the pandemic led to heightened market volatility and a temporary decline in the Dow Jones index. After that, as interest rates stabilized and remained low from 2020 to 2022, the Dow Jones index resumed its upward trajectory. The continuation of stable interest rates during this period provided a supportive environment for stocks in the Dow Jones as investors remained optimistic about economic growth and corporate profitability prospects.

4. **Common trend across the three indexes**

While lowering interest rates is generally associated with accommodative monetary policy and economic motivation, there are scenarios in which other factors may override the

positive impact of lower interest rates on stock market performance. One possible explanation for this parallel decline in stock index and interest rates is that market participants may interpret decreasing interest rates as a response to economic weakness or concerns about future growth prospects. In such cases, the perceived negative economic outlook could outweigh the potential benefits of lower borrowing costs, leading to a decline in investor sentiment and stock prices. Moreover, decreasing interest rates may signal that the Federal Reserve is trying to address specific economic challenges or risks, such as deflationary pressures or financial instability, making investors more cautious and creating downward pressure on stock prices.

Therefore, despite the common perception that decreasing interest rates stimulate economic activity, the observed relationship patterns between interest rates and stock market indices such as the S&P 500, NASDAQ, and Dow Jones Composite Index show that these indices only perform well if interest rates are stable and consistently low. This is because stable interest rates are crucial for creating a predictable and favorable environment for economic activity. Unlike volatile interest rates that can cause hesitation and disrupt financial planning, stable rates offer businesses and consumers confidence and clarity in their financial decisions. This stability enables them to accurately evaluate borrowing and investment costs over the long term, facilitating strategic financial planning and decision-making.

Accordingly, stable interest rates are indeed crucial for businesses as they support long-term investment plans and capital expenditures. Consistent interest rates empower companies to confidently invest in new technologies, expand operations, and undertake research and development initiatives. Similarly, stable interest rates also benefit consumers by maintaining affordable borrowing costs and fostering predictable financial planning. Whether purchasing a home, financing education or investing, consumers rely on stable interest rates to

make informed financial decisions. Additionally, stable interest rates contribute to financial stability by mitigating the risks associated with interest rate volatility and eliminating sudden fluctuations in interest rates that lead to asset price volatility and increased market uncertainty.

In summary, the observed correlation between stable interest rates and economic growth, as evidenced by the trends in the figures, underscores the importance of maintaining low and predictable interest rates to foster sustainable economic expansion and financial stability. While interest rate decreases may stimulate economic activity in certain circumstances, stable rates provide a solid foundation for long-term economic growth, investment, and prosperity.

B. External factors that may mediate the impact of interest rates on stock market indices

1. **Relationship between interest rate and crude oil price**

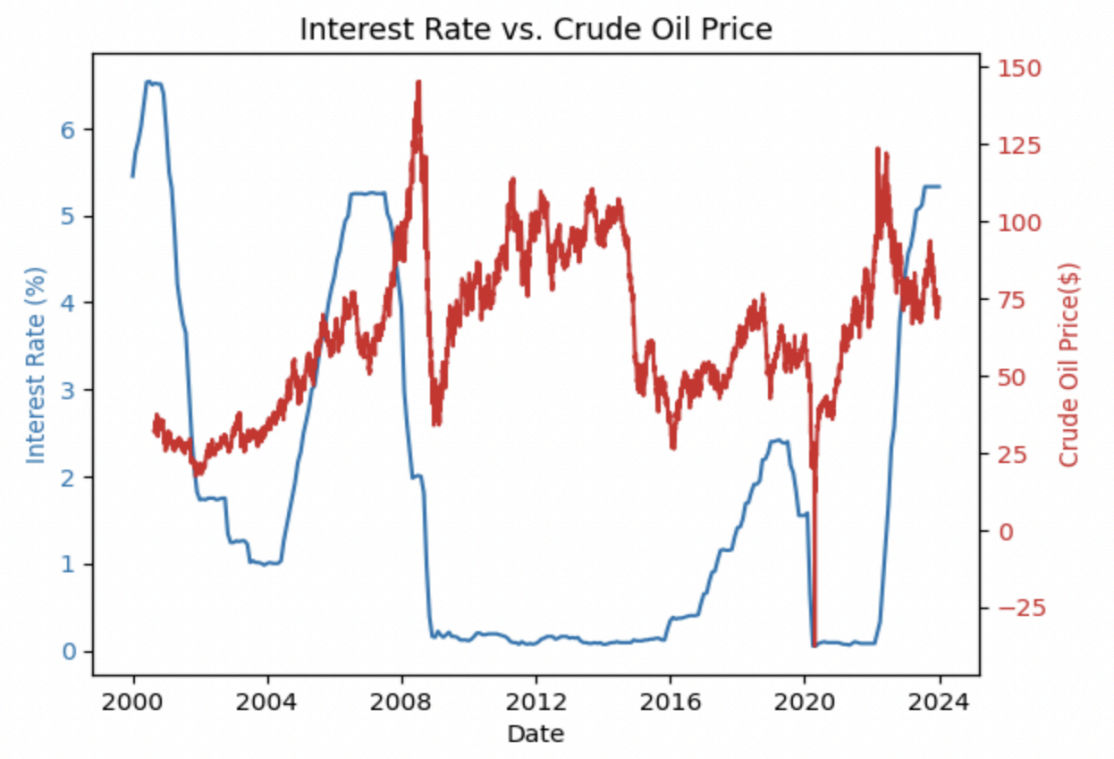


Figure 4: Relationship Between Federal Funds Effective Rate and Crude Oil Prices: The Federal Funds Effective Rate Data was collected from the Federal Reserve Economic Data (FRED) and Crude Oil Prices was collected from Yahoo Finance (1/1/2000-1/1/2024)

The graph in Figure 4 clearly shows one significant peak and trough in crude oil prices over the past two decades: one in 2008 and another in 2020. In 2008, oil prices soared to nearly $145, primarily driven by political instability and conflicts in oil-producing regions, especially the Middle East, as well as rising global demand and speculative trading. However, in 2020, due to reduced demand due to COVID-19 lockdowns and logistical challenges in storing excess oil, prices sharply declined, dropping into negative, reaching approximately -$36 at one point, demonstrating the volatility of the oil market.

While lower interest rates could potentially stimulate economic activity, potentially boosting oil demand and its price, the relationship between interest rates and oil price is more complex. In Figure 4, the graph illustrates dynamic dances of peaks and troughs instead of a linear trajectory or a stable progression. This continuous fluctuation underscores the inherent volatility of the oil market, where prices are subject to various influencing factors, ranging from geopolitical tensions in oil-producing regions to changes in global economic growth. Furthermore, the graph underscores the nature of oil prices, where periods of expansion and prosperity are often followed by periods of contraction and uncertainty. This observation underscores the importance of understanding the factors that shape the oil market and the necessity for adaptability and resilience in navigating their inherent fluctuations.

In conclusion, it is reasonable to suggest that changes in interest rates exert a more indirect influence on oil prices than other economic indicators. For instance, changes in interest rates can influence currency exchange rates, impacting the purchasing power of oil-importing countries and, thus, oil demand and price. Additionally, shifts in interest rates can influence investment decisions in sectors that depend on oil production and consumption, which may affect supply and demand dynamics over time. However, the precise relationship between interest rates

and oil prices is complicated, and other factors, such as geopolitical events like the Arab Spring or the US-Iran tensions, supply disruptions like the OPEC oil embargo, and global economic trends like the 2008 financial crisis, often play more immediate and direct roles in driving oil price movements. Therefore, while interest rates are an important economic indicator, their impact on oil prices is typically less immediate and noticeable than other factors.

2. US Dollar Index

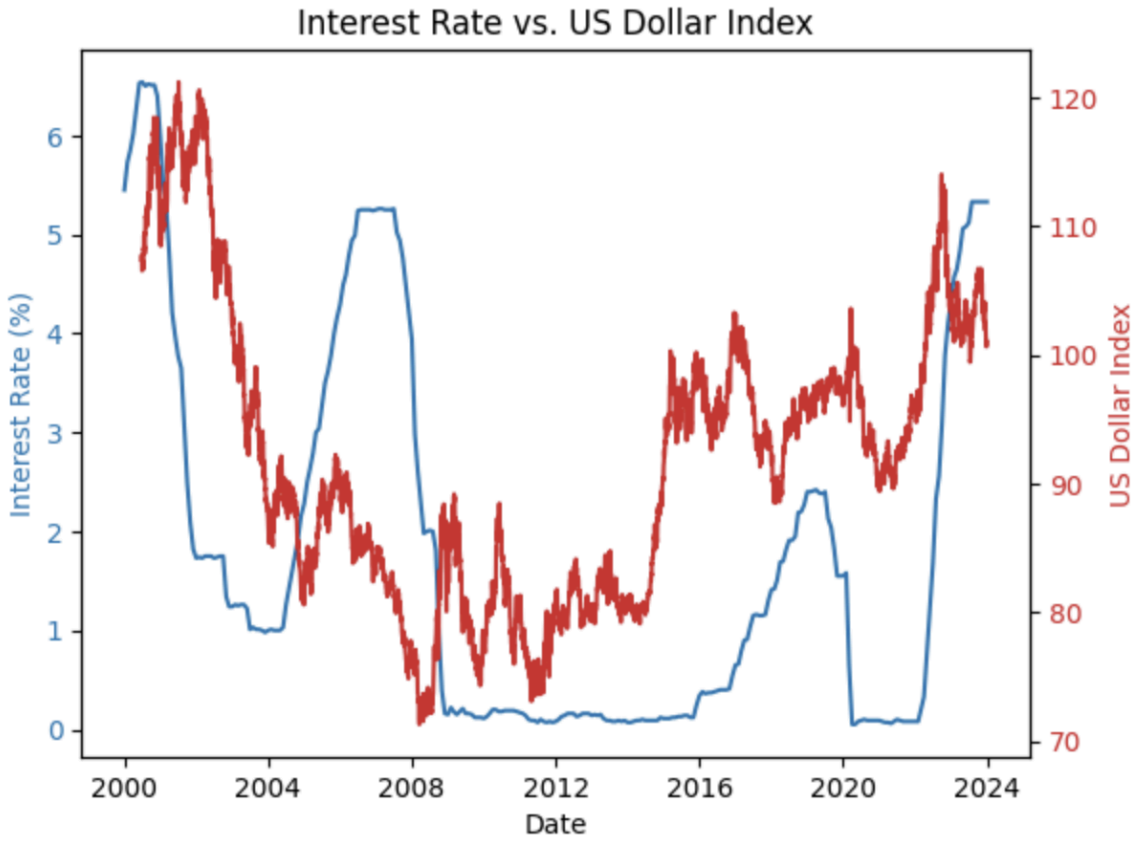


Figure 5: Relationship Between Federal Funds Effective Rate and US Dollar Index: The Federal Funds Effective Rate Data was collected from the Federal Reserve Economic Data (FRED) and US Dollar Index was collected from Yahoo Finance (1/1/2000-1/1/2024)

It is really fascinating how financial markets work when observing the relationship between the dollar index and interest rates. Examining the period from 2000 to 2004 in Figure 5,

it is evident that when interest rates go up, the dollar index also tends to rise; when interest rates drop, the dollar index tends to fall. This relationship can be explained by considering the role of intermediary factors, especially the inflation rates, which significantly influence monetary policy and, consequently, the dollar index movements. When inflation is high, the Federal Reserve raises interest rates to restrain economic activity and prevent excessive price increases to maintain and strengthen the value of the dollar. This action makes the dollar more attractive to investors, as they can earn higher investment returns by trading the dollar compared with other currencies, which leads to an increase in the dollar index. In contrast, when inflation is falling or stable, central banks may lower interest rates to stimulate economic growth and encourage borrowing and spending, which makes other investments, such as stock or real estate, more attractive and profitable than the dollar, causing a decline in the dollar index.

However, things get interesting when we look at the years from 2014 to 2015. Instead of the usual pattern where interest rate increases lead to an increase in the dollar index, the graph shows something different. The dollar index goes up first, and then interest rates rise later. One reason for this could be that investors and traders were already expecting interest rates to go up based on the existing high inflation rates, so they started buying dollars in anticipation of higher interest rates. When the interest rate eventually increases, investors may not be surprised because it was already expected, and the dollar index does not fluctuate extensively. If inflationary pressures continue to persist, the Federal Reserve might have signaled its intention to raise interest rates in response. At this time, market participants could have bought more dollars or sold other currencies, which continued to boost the strength of the dollar index.

In conclusion, inflation rates and many other factors can influence currency worth, and it is essential to consider all of them when trying to understand and explain market behavior and make investment decisions.

3. Gold

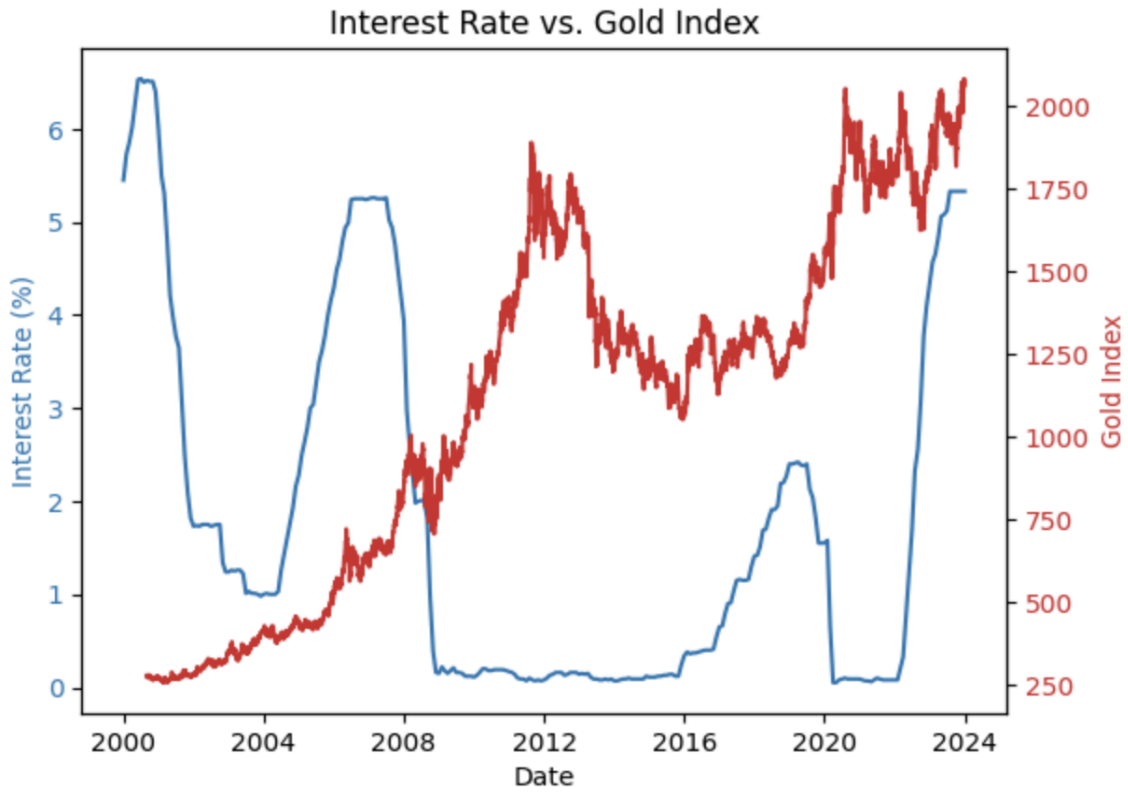


Figure 6: Relationship Between Federal Funds Effective Rate and Gold Index: The Federal Funds Effective Rate Data was collected from the Federal Reserve Economic Data (FRED), and the Gold Index was collected from Yahoo Finance (1/1/2000-1/1/2024)

Both economic factors and human psychology influence the relationship between the gold index and interest rates. When the Federal Reserve lowers interest rates, fixed-income investments become less appealing. Therefore, investors will seek other alternative investment options to make profits. Gold, which has been considered to have a reliable value, appears to be a

compelling option under such circumstances. Unlike other financial instruments that are tied to interest rates, the value of gold is not eroded over time or easily impacted by monetary policy decisions. Gold is considered a scarce and tangible asset with enduring attraction, especially during economic uncertainty or inflationary pressures.

During 2009-2012 and 2019-2021, because interest rates declined or remained low, investors switched to investing in gold, which increased its price and, consequently, the gold index. As the gold price increased, traders and speculators realized the trend and entered the market to arbitrage. This inflow of short-term opportunistic behavior led to heightened volatility and increased the gold price and index even more. At this time, investors and traders will start to sell gold simultaneously to earn profits, making the gold price experience a temporary decrease, causing fluctuations in the gold index.

Nevertheless, despite these short-term fluctuations, the attractiveness of gold's value remained unchanged. Investors still consider gold to be a reliable long-term investment and an effective tool to hedge against market volatility. Consequently, after each downturn, investors still buy gold, which then drives the gold price and index back up. This pattern of exploitation and subsequent correction will keep repeating, showing how human emotions and speculative behavior often intersect with economic conditions. Therefore, understanding this cycle is crucial for investors to navigate the gold market effectively in the volatile market.

4. **Commodity**

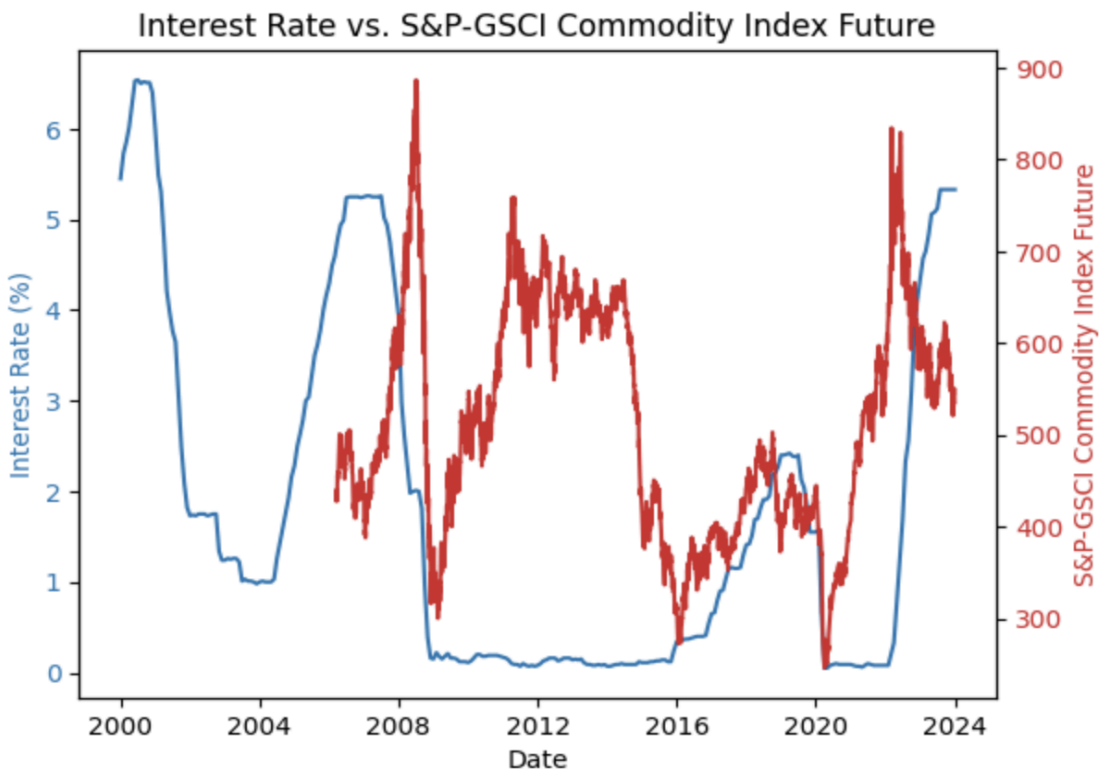


Figure 6: Relationship Between Federal Funds Effective Rate and S&P-GSCI Index: The Federal Funds Effective Rate Data was collected from the Federal Reserve Economic Data (FRED), and S&P-GSCI Index was collected from Yahoo Finance (1/1/2000-1/1/2024)

From Figure 6, from 2020 to 2022, while interest rates were maintained at 0 to 0.25%, it is evident that the S&P-GSCI (a widely recognized index that measures the performance of a basket of commodities) has consistently increased from 250 to 850. This upward trend can be due to various factors, but the most crucial factor is COVID-19. Firstly, because of the COVID-19 pandemic, many people lost their jobs, which decreased consumers' spending power as people lost their primary financial resources. Additionally, lockdowns and restrictions during COVID-19 also caused disruptions in various supply chains of goods and materials. These disruptions increased input costs for many businesses because companies had to pay more for production and transportation. On the other hand, due to the lockdown, businesses had to endure

the shortage as they could not get the inputs they needed. The combination of these factors creates a situation where demand exceeds supply, which boosts the prices of goods and services and rapidly increases the inflation rates.

Therefore, the Federal Reserve needed to raise interest rates rapidly from 0.25% to 5.75% from 2022 to 2023 to slow down economic activity and decrease inflationary pressures to maintain price stability and strengthen the economy's long-term health. After the Federal Reserve increased its interest rate, the S&P-GSCI decreased from 850 to 550 from 2022 to 2023, which shows the effectiveness of monetary policy in addressing the inflation rate and commodity prices. In contrast, during the global financial crisis in 2008, the Federal Reserve aggressively cut interest rates to stimulate economic activity, encourage borrowing and spending, and stabilize financial markets. However, the S&P-GSCI decreased rapidly from about 880 to 300 due to the economic downturn and reduced consumer spending during the crisis. These examples show that complex economic conditions, market sentiment, and policy decisions influence the relationship between commodity index futures and interest rates. While increases in commodity prices may encourage the Federal Reserve to raise interest rates to combat inflation, the impact of interest rate changes on commodity prices can vary depending on the economic context and performance of the economy.

Conclusions and Implications for the Future

In conclusion, the relationship between interest rates and stock market indices like the S&P 500, NASDAQ Composite, and Dow Jones Industrial Average is a fascinating interplay of economic forces. When interest rates rise, stock indices performance tends to decline, reflecting investor concerns about tighter monetary policy and its potential impact on borrowing costs and economic activity. Conversely, stable or declining interest rates typically coincide with stock

market gains, as lower borrowing costs stimulate investment and consumer spending. However, it is essential to emphasize that stock indices often perform best when interest rates remain stable. This stability fosters strategic financial planning and decision-making, providing businesses and consumers with certainty and predictability in their financial endeavors. This environment encourages investment, borrowing, and spending, thus stimulating economic growth.

The relationship between interest rates and crude oil prices is a complex and intriguing subject that defies traditional economic theories. While some argue that lower interest rates can theoretically boost oil demand and stimulate economic activity, my research, as depicted in the graph, reveals no linear or statistical relationship between interest rates and crude oil. Changes in interest rates may exert an indirect or delayed influence on oil prices compared to other economic indicators. For instance, interest rates can influence currency exchange rates and investment decisions in oil-related sectors over time. However, other factors, such as geopolitical events, supply disruptions, and global economic trends, often play more immediate and direct roles in driving oil price movements. Therefore, while interest rates are important economic indicators, their impact on oil prices is typically less immediate and noticeable than other factors, making this relationship a puzzle worth exploring.

The relationship between the dollar index and interest rates is a key indicator of financial market performance, heavily influenced by inflation rates. In periods of high inflation, central banks typically raise interest rates to curb excessive economic activity and prevent uncontrolled price increases. This move attracts investors seeking higher returns, strengthening the dollar and increasing the dollar index. Conversely, during low or falling inflation, central banks may choose to lower interest rates to stimulate economic growth. This makes the currency less appealing

compared to higher-yielding alternatives, leading to a weakening of the dollar and a corresponding decrease in the dollar index. Therefore, understanding this relationship provides valuable insights into the performance of financial markets and central banks' monetary policy decisions.

Exploring the connection between the gold index and interest rates, we can see that it is influenced by various economic factors and human behavior, with central banks playing a vital role. When interest rates are low, investors seek alternative assets for profit, and they see gold as an attractive choice due to its historical reliability as a store of value unaffected by monetary policy decisions, leading to increased demand for gold, driving up its price and the gold index. However, this surge attracted short-term traders and speculators who only wanted to arbitrage and get short-term profit, resulting in heightened volatility and temporary setbacks in gold prices. Despite these fluctuations, the underlying appeal of gold as a hedge against economic uncertainty remained consistent. Investors continued to view gold as a stable investment, particularly during geopolitical tension or inflationary pressures, leading to an increase in buying interest after each downturn. This cyclical pattern, where emotions and speculation intersect with economic fundamentals, reflects financial market dynamics and provides investors with valuable insights.

Shifting the focus to the interaction between commodity index futures and interest rates is influenced by many factors, ranging from fundamental economic principles to the general sentiment in financial markets and the policy decisions made by central banks. While it is commonly understood that rising commodity prices can trigger central banks to raise interest rates to counter inflationary pressures, the impact of interest rate adjustments on commodity prices can be complicated as it dramatically impacts the broader economic landscape and the nature of any ongoing crises. For instance, during periods of economic downturns, such as the

global financial crisis in 2008, central banks often resort to cutting interest rates as part of expansive monetary policy measures aimed at stimulating economic activity. Paradoxically, this initial reduction in interest rates may lead to a temporary decrease in commodity prices.

In conclusion, from the impact on stock market indices to the dynamics of commodity prices and currency values, it's clear that interest rates are a significant factor in shaping economic outcomes. However, this relationship is far from linear, with numerous other factors, such as geopolitical events, supply disruptions, and investor sentiment playing crucial roles. One consistent theme that emerges is the critical importance of stability and predictability in interest rate movements. While fluctuations are unavoidable, maintaining a steady monetary policy instills confidence among market participants, thus fostering sustainable economic growth. A comprehensive analysis that considers the broader economic context surrounding interest rate changes is also essential. By understanding the intricate dynamics at play, policymakers, investors, and businesses can make more informed decisions, navigate the complexities of global finance with transparency, and prevent crash risk in the future.

Implications for Future Research:

To better understand the relationship between interest rates and market performance, it would be beneficial to investigate the application of artificial intelligence (AI) and machine learning (ML) in financial modeling. Using advanced algorithms and data analytics can transform our approach to analyzing the stock market. By employing these technologies, such as machine learning algorithms like neural networks or random forests, we can leverage historical data to forecast future trends and uncover previously undetected patterns, enhancing the accuracy and speed of market predictions. Additionally, incorporating AI and ML into financial models could improve risk management by helping investors navigate the challenges of interest rate

fluctuations and prevent risk due to sudden changes in interest rates, thus improving portfolio resilience and performance. Such technologies also have the potential to bolster market regulation and fraud prevention, thereby strengthening investor confidence and maintaining market integrity. This research topic promises to yield significant insights and tools for understanding and managing the dynamics of financial markets more effectively.

Furthermore, exploring the policy implications of various interventions on market stability and financial health can provide invaluable insights for shaping effective future strategies. This analysis can help policymakers understand how different policy measures influence market dynamics and investor behavior, thereby guiding them to select the most effective approaches to promote stability and drive growth. By examining past policy responses to market fluctuations, policymakers can determine which strategies were successful and which were not, leading to more precise and impactful future policies. Additionally, a deeper understanding of the long-term effects of these policies can empower policymakers to anticipate and mitigate potential risks such as market bubbles or systemic crises, thereby strengthening economic resilience.

Moreover, behavioral finance insights are also critically important as they illustrate how investors' emotions, biases, and collective behaviors influence market outcomes. Therefore, it is crucial to research how investor sentiment interacts with interest rate changes, which can unveil trends and patterns that traditional economic models may overlook. This deeper understanding of investor psychology can aid in devising strategies that mitigate the adverse effects of irrational behavior. Such strategies are crucial for improving risk management and refining investment decision-making processes. Understanding these dynamics allows us to develop more effective tools and approaches to maintain market stability and enhance financial decision-making under

varying economic conditions, highlighting the relevance and significance of our work in the financial sector.

Not only economic factors but also geopolitical events, such as wars, conflicts, and political instability, can also have a significant impact on market performance. Political instability can also lead to changes in government policies that impact businesses. For example, a change in government leadership or policy direction can result in changes to regulations, taxes, or trade agreements, which will impact the profitability and operations of businesses. Therefore, understanding how these events can affect market performance is necessary in adjusting market strategies and maintaining a stable market performance.

By exploring these research topics, we can deepen our understanding of the complicated links between interest rates and stock market performance, equipping various stakeholders with the tools and knowledge to navigate the complex financial market world. Through cross-disciplinary collaboration and technological innovation, we can create stronger policies, strategies, and tools to promote stability, drive economic growth, and protect investor interests in our dynamic and interconnected global financial system.

Limitations:

This thesis, based on historical data, may not fully capture market conditions or reflect the complete picture of economic interactions. It's crucial to understand that these data limitations can lead to incomplete or biased insights. Moreover, market efficiency theories suggest that market anomalies or trends that provide potential advantages are corrected quickly, bringing prices back to their actual values. Therefore, while some trends in this thesis can benefit investors, it's vital to note that the trends identified in this research should not be used as a basis for future investment decisions, as they do not guarantee similar future occurrences. This

recognition of limitation is paramount for investors when interpreting the findings and implications of this study.

By acknowledging and addressing these limitations, future research can refine its methodologies and enhance the accuracy and relevance of its findings. The revised future research can provide more comprehensive guidance for policymakers, investors, and businesses to navigate the intricacies of global financial markets.

Bibliography

Andreou, P. C., C. Louca, and A. P. Petrou, 2017, CEO age and stock price crash risk, Review of Finance 21, 1287–1325.

Andreou, P. C., C. Antoniou, J. Horton, and C. Louca, 2016, Corporate governance and firm-specific stock price crashes, European Financial Management 22, 916–956.

Bates, D. S. (2008). The market for crash risk. Journal of Economic Dynamics and Control, 32(7), 2291-2321.

Boubakri, Narjess & Cosset, Jean-Claude & Saffar, Walid. (2011). The Impact of Political Connections on Firms' Operation Performance and Financing Decisions. Journal of Financial Research. 35. 10.2139/ssrn.1242402.

Callen, Jeffrey L. and Fang, Xiaohua, Short Interest and Stock Price Crash Risk (August 19, 2015). Journal of Banking and Finance, Forthcoming, Rotman School of Management Working Paper No. 2647384, Available at SSRN: https://ssrn.com/abstract=2647384

Callen, J. L., & Fang, X. (2013). Institutional investor stability and crash risk: Monitoring versus short- termism?. *Journal of Banking & Finance*, 37(8), 3047-3063.

Callen, J. L., & Fang, X. (2015a). Short interest and stock price crash risk. *Journal of Banking & Finance*, 60, 181-194.

Callen, J.L., & Fang, X. (2015b). Religion and stock price crash risk. *Journal of Financial and Quantitative Analysis*, 50 (1&2), 169–195.

Campbell, J.Y., & Hentschel, L. (1992). No news is good news: an asymmetric model of changing volatility in stock returns. *Journal of Financial Economics*, 31, 281–318.

Campbell, J., Hilscher, J., & Szilagyi, J. (2008). In search of distress risk. *The Journal of Finance*, 63(6), 2899–2939.

Cao, H., Coval, D., & Hirshleifer, D. (2002). Sidelined investors, trading-generated news, and security returns. Review of Financial Studies, 15(2), 615–648

Chen, J. (2022, January 2). *Guide to Stock Market Crashes*. Investopedia. https://www.investopedia.com/terms/s/stock-market-crash.asp#:~:text=A%20stock%20market%20crash%20is,a%20long%2Dterm%20speculative%20bubble

Cheng, Q., J. Lee, and T. Shevlin, 2016, Internal governance and real earnings management, The Accounting Review 91, 1051–1085.

Cheng, F., Wang, C., Chiao, C., Yao, S., & Fang, Z. (2021). Retail attention, retail trades, and stock price crash risk. Emerging Markets Review, 49, 100821.

Early, J. (2023, March 10). How Jerome Powell Killed Silicon Valley Bank. Forbes. https://www.forbes.com/sites/jamesearly/2023/03/10/how-jerome-powell-killed-silicon-valley-bank/?sh=17cabdc55603

Farrell, M. (2023, March 14). Inside the collapse of Silicon Valley Bank. The New York Times. https://www.nytimes.com/2023/03/14/business/silicon-valley-bank-gregory-becker.html

"Federal Funds Effective Rate." *Federal Reserve Economic Data*, Federal Reserve Bank of St. Louis, Accessed 1 March 2024, fred.stlouisfed.org/series/DFF.

Fisman, Raymond. "Estimating the Value of Political Connections." *The American Economic Review*, vol. 91, no. 4, 2001, pp. 1095–102. *JSTOR*, http://www.jstor.org/stable/2677829. Accessed 11 May 2024.

Gobler, E. (2023, September 28). What Happened to Silicon Valley Bank? https://www.investopedia.com/what-happened-to-silicon-valley-bank-7368676

Gu, X., Xin, Y., & Xu, L. (2019). Expected stock price crash risk and bank loan pricing: Evidence from China's listed firms. Pacific-Basin Finance Journal, 57, 101166.https://doi.org/10.1016/j.pacfin.2019.06.013

Habib, A., Hasan, M.M. and Jiang, H. (2018), Stock price crash risk: review of the empirical literature. Account Finance, 58: 211-251. https://doi.org/10.1111/acfi.12278

He, G., 2015, The effect of CEO inside debt holdings on financial reporting quality, Review of Accounting Studies 20, 501–536.

"Historical Data of S&P 500 (^GSPC) ." *Yahoo! Finance*, Yahoo!, Accessed 1 Mar. 2024, finance.yahoo.com/quote/%5EGSPC/history.

"Historical Data of NASDAQ Composite (^IXIC) ." *Yahoo! Finance*, Yahoo!, Accessed 1 Mar. 2024, https://finance.yahoo.com/quote/%5EIXIC/history

"Historical Data of Dow Jones Industrial Average (^DJI)." *Yahoo! Finance*, Yahoo!, Accessed 1 Mar. 2024, https://finance.yahoo.com/quote/%5EDJI/history?fr=sycsrp_catchall

"Historical Data of Crude Oil Jun 24 (CL=F)." *Yahoo! Finance*, Yahoo!, Accessed 1 Mar. 2024, https://finance.yahoo.com/quote/CL%3DF/history?period1=967003200&period2=1715145853

"Historical Data of US Dollar Jun 24 (DX=F)." *Yahoo! Finance*, Yahoo!, 1 Mar. 2024, https://finance.yahoo.com/quote/DX%3DF/history

"Historical Data of Gold Jun 24 (GC=F)." *Yahoo! Finance*, Yahoo!, Accessed 1 Mar. 2024, https://finance.yahoo.com/quote/GC%3DF/history

"Historical Data of S&P-GSCI Commodity Index Future (GD=F)." *Yahoo! Finance*, Yahoo!, Accessed 1 Mar. 2024, https://finance.yahoo.com/quote/GD=F?.tsrc=fin-srch

Hutton, A. P., A. J. Marcus, and H. Tehranian, 2009, Opaque financial reports, R2, and crash risk, Journal of Financial Economics 94, 67–86.

Jagannathan, R., Pelizzon, L., Schaumburg, E., Sherman, M. G., & Yuferova, D. (2022). Recovery from fast crashes: Role of mutual funds. Journal of Financial Markets, 59, 100646.

Jin, L., & Myers, S. C. (2006). R2 around the World: New theory and new tests. *Journal of Financial Economics,* 79(2), 257-292.

J.P. Morgan. (2023, March 14). How does the Silicon Valley Bank collapse impact our outlook?. J.P. Morgan Private Bank Asia. https://privatebank.jpmorgan.com/apac/en/insights/markets-and-investing/how-does-the-silicon-valley-bank-collapse-impact-our-outlook

Kenton, W. (2021, November 26). *Crash: What it Means, How it Works, Examples*. Investopedia. https://www.investopedia.com/terms/c/crash.asp

Kim, J.-B., Y. Li, and L. Zhang, 2011a, CFOs versus CEOs: equity incentives and crashes, Journal of Financial Economics 101, 713–730.

Kim, J.-B., Y. Li, and L. Zhang, 2011b, Corporate tax avoidance and stock price crash risk: firm-level analysis, Journal of Financial Economics 100, 639–662.

Kim, Y., H. Li, and S. Li, 2014, Corporate social responsibility and stock price crash risk, Journal of Banking and Finance 43, 1–13.

Kim, J. B., Wang, Z., & Zhang, L. (2016). CEO overconfidence and stock price crash risk. Contemporary Accounting Research, 33(4), 1720-1749.

Li, X., Wang, S. S., & Wang, X. (2017). Trust and stock price crash risk: Evidence from China. *Journal of Banking & Finance*, 76, 74–91.

Reilly FK, Wright DJ, Johnson RR. Analysis of the interest rate sensitivity of common stocks. Journal of Portfolio Management. 2007;33(3):85-107,8.

http://silk.library.umass.edu/login?url=https://www.proquest.com/scholarly-journals/analysis-interest-rate-sensitivity-common-stocks/docview/195581220/se-2

Rennison, J. (2023, March 10). A bank failure jolts markets, sending stocks down sharply. The New York Times. https://www.nytimes.com/2023/03/10/business/stock-market-jobs-report.html

What Investors Should Know About Interest Rates? https://www.investopedia.com/articles/fundamental/04/061604.asp

Xie, B., W. N. III Davidson, and P. J. DaDalt, 2003, Earnings management and corporate governance: the roles of the board and the audit committee, Journal of Corporate Finance 9, 295–316.

Xu, Y., Xuan, Y., & Zheng, G. (2021, March 7). Internet searching and stock price crash risk: Evidence from a quasi-natural experiment. Journal of Financial Economics. https://www.sciencedirect.com/science/article/abs/pii/S0304405X21000933