Analyzing the Sentiment of Tweets Regarding Sustainability Practices to Predict Stock Performance

Shankar Chakkera[1], Amy Anderson[1#], Bryce White[1#] and John Almasan[1#]

[1]BASIS Charter School
[#]Advisor

ABSTRACT

In recent years, sustainability has entered the mainstream consciousness of citizens, policy makers and companies across the globe. A key factor of sustainability in the investing world is ESG (environmental, social, governance) scores that demonstrate how sustainable the actions and decisions of a company are for employees, shareholders, and its ecosystem. In the United States, there has been a political divide in ESG values as investors seek to balance their drive to maximize shareholder value and promote positive change in society for all stakeholders. One platform that debate has occurred on is Twitter where users express their opinions on various companies. I analyzed the sentiment of users' tweets on companies that have been regarded as sustainability leaders and companies that are laggards in this area. My analysis was completed through the Python coding language, a programming language designed for statistical computing and graphics. This data was then correlated with the stock performances of these respective companies during specific time frames of high Twitter activity. Ultimately, I sought to determine whether social media has a significant influence on the stock market and whether that will play a large part in driving sustainable change which will improve the environmental and social consciousness in the United States. Future research can identify what specific ideas or principles regarding sustainability are most widely discussed on Twitter and how this in turn relates to the decisions that companies make on key public policy issues.

Introduction

In recent years, sustainability has developed remarkably and reached global mainstream consciousness. A significant advancement towards a sustainable future occurred in 2015 when the United Nations created a list of 17 Sustainable Development Goals as part of a 2030 agenda which was a call to action for all countries to promote prosperity and protect the planet (World Health Organization). According to Investopedia, one category of sustainability is business sustainability, a business approach to create long-term value by understanding how the organization operates in a social, ecological, and economic environment.

Background and History

A key framework that assesses business sustainability in the investing world is the environmental, social, and corporate governance (ESG) score that demonstrates how sustainable the actions and decisions of a company are. There are a variety of ESG analysis tools such as Sustainalytics, MSCI, and Morningstar that screen and report key ESG findings to consumers and investors (Boffo, 2020). With the push for sustainability practices in recent years, the ESG agenda of companies is becoming more important and publicized. In December of 2022, the investment firm Blackrock had billions of dollars withdrawn after facing backlash from the GOP Florida Governor Ron DeSantis regarding ESG investments. Many conservative political leaders claimed that Blackrock was n proper fiduciary responsibility by

putting taxpayers' retirement funds in significant ESG investments (Bloomberg 2022). This clash in ideology is becoming more prevalent and investors must be wary of the influence of ESG ideology and advocacy on company managements and their boards of directors. Thus, it is important to examine whether this divide in ESG may be further exacerbated with the advent of social media that can distort the reality of a company's actions on its intrinsic shareholder value.

The advent of ESG began in 2006 when the United Nations published their Principles for Responsible Investment Report (Atkins, 2020). For the first time, ESG criteria was required in a company's financial evaluations. Since then, ESG has been an area of focus with 63 investment companies with combined $6.5 trillion dollars in assets. The metrics have also been expanded to provide a comprehensive framework for more objectively measuring the ESG quality of companies. Recently, in May of 2022, the US Securities and Exchange Commission created an ESG disclosure framework for consistent and accurate information. Ultimately, companies who maintain high standards of ESG have consistently achieved higher returns and lower risks (Horton & Jessop, 2022).

ESG Investor Ideology

When understanding ESG in the media space, behavioral finance must be explored to understand the ideology of these investors. At a basic level, behavioral finance is an area of study focusing on how the psychology of investors influences market outcomes. It is important to recognize that investors have various preferences and that these motives are not always monetary based. Unlike traditional finance that assumes investors are rational actors who have no biases in their investment decision making process, behavioral finance considers a human's emotions, biases, and cognitive limitations. Meir Statman expresses this idea stating, "While standard finance assumes a perfectly rational investor, behavioral finance describes an investor as a person who does not perfectly process all available information, is not perfectly informed and is not solely guided by economic motives" (Briehl 2022). ESG investing falls under a behavioral finance approach because it allows investors to act on their beliefs and to invest money in causes and issues that they feel are important. Briehl continues that "To integrate ESG factors into investments, several sustainable investment strategies are adopted which could be either used independently or, more frequently, combined with each other." These strategies are explained by an empirical study conducted by Riedi and Smeets in 2017. "Their main finding was that especially intrinsic social preferences and social signaling rather than financial returns play a crucial role in investing in ESG focused companies. Investing in accordance with social preferences means to pay a premium to invest in a socially responsible manner. Social signaling is important for investors for reputational reasons and therefore to create a positive social image. They also stated that investors who talk more often about their investments are more willing to steer their investment to ESG mutual funds and that ESG investments are not a substitute for charity donations."

There were a few other key studies that analyzed how investors understand and track ESG scores when evaluating companies. Elfimova et al. (2018) explains how investors, especially institutional investors, screen for negative ESG factors to ensure they don't incur significant long-term loss. Lee et al. (2022) further presents the effects of the negative external ESG factors when discussing how greenwashing, the false advertising of sustainable practices of companies, can lead to a decline in a firm's green brand. This false advertising is often done on social media or websites that are external sources of information from the company.

Certain factors improve a company's ESG scores. One study by Crace and Gehman in 2022 found that "Majority of heterogeneity in ESG performance is explained by internal factors such as the CEO and the firm, and female CEOs and educational background in humanities are associated with MSCI strengths." This study emphasizes the effect of internal factors on the ESG score and reliability of a company.

However, biases do arise from investing in ESG funds such as the home bias, industry bias, and the lack of diversity in holdings for certain investors. (Briehl, 2022) The home bias explains how ESG investors tend to only invest in domestic funds or assets. In addition, the industry bias reveals how mature and regulated industries like banks, telecommunication, and technology sectors often have more favorable scores as well as renewable energy

industries because they are less exposed to ESG risk. This type of bias can significantly affect the way investors perceive how sustainable certain companies are within a fund.

In addition to the biases involved in ESG investing, there seems to be a lack of uniformity in the type of filters investors are using to evaluate companies. Berg et. al conducts an empirical study investigating six prominent ESG rating agencies (Kinder, Lydenberg, and Domini (KLD), Sustainalytics, Moody's ESG (Vigeo-Eiris), S&P Global (RobecoSAM), Refinitiv (Asset4), and MSCI) and finds that the correlations between the ratings are on average 0.54 and range from 0.38 to 0.71. It shows that this lack of consistency is apparent in ESG ratings and this can result in differences between investor's decisions depending on their sources.

Media's Impact on ESG Investing

While there are a variety of platforms that provide information to investors, social media has certainly contributed to the dissemination of investing beliefs over the last few years. According to J.P Morgan Wealth Management, "almost 80% of institutional investors use social media as part of their regular workflow, and approximately 30% of them said that information they gathered on social media has influenced an investment recommendation or decision." Social media has also increased financial literacy among Gen Zers and millennials creating more opportunity for the younger generation to invest. Although this has provided many benefits, there are risks such as herding or social proof associated with a rise in investors with limited investment fundamentals evaluation knowledge. This was exemplified during the trading surges of meme stocks and cryptocurrency. "For example, a Reddit thread with more than 3.1 million subscribers spurred a trading frenzy for GameStop's stock in January 2021, prompting the stock price to leap to unprecedented heights. Social media management company Sprout Social tracked mentions of GameStop on social media during that time and found that nearly 1.6 million tweets, 82,000 Reddit mentions and 1,465 YouTube videos about the video game retailer were posted between January 20 and January 27" (Dure, 2021). Herding on social media ultimately creates a distorted perception of reality through hype, publicity, and selective presentation which can confuse or mislead novice and uninformed investors.

Twitter is a huge social media platform where users are often talking about finance and investing. In fact, "in May 2021 alone, Twitter saw 1.3M conversations about finance across Europe" and this has reached millions of users as "41% of people on Twitter say they see financial and business news on Twitter that can affect their investment decisions" (Twitter Marketing). There have been a few studies published that look directly at how Twitter influences the investing world. One study conducted by Novak et. al analyzed a total of 668,529 tweets that were collected using the queries of relevant users, single hashtags, combined hashtags, and hashtags of major impact investing events. Novak further performed a sentiment analysis of the tweets and found them to be predominantly neutral with some leaning towards the positive side. The most common hashtags were #socent and #impinv in the retweet community and #csr, #esg and #socialenterprise in one defined community. Lastly, the study revealed that the public sector, media, and academia are not very influential users in the ESG discussions.

Although the media may not play a direct role on Twitter and sway the perception of consumers, companies use Twitter to sway consumers and other users' beliefs about their sustainability practices. Their presence on social media also can sway their official ESG ratings because they can emphasize their sustainability strengths and discredit their sustainability weaknesses. Lyon and Montgomery performed a study on corporate greenwash revealing that there are different strategies that companies must adopt in order to appease their consumers and report true information about their practices. They conclude that "Firms with green reputations should consider reducing promotion of their green accomplishments in periods when they have bad news to report as well, while firms with brown reputations (a reputation that leans toward unsustainable actions) should consider disclosing their full environmental impacts in the same circumstances." These studies reveal that companies should be aware of their sustainability reputations and act accordingly to satisfy their consumers and investors.

Overall, ESG is becoming more mainstream and prevalent nowadays. Because of the push for sustainability, investment companies and managers are incorporating these issues into their financial decisions. Social media platforms like Twitter will continue to play a large part in shaping the public's opinion and sentiment of sustainability issues. This paper will investigate whether opinions about sustainability on Twitter makes a significant impact on investment returns.

The Gap

The gap for my research paper lies at the intersection of social media semantics and stock performance. Although some studies have analyzed the effects of Twitter on the stock market and common trends and keywords, there are no major studies on how Twitter semantics play a role in influencing investor attitudes and whether that translates to changes in stock price. This paper will investigate whether opinions and news about companies on Twitter with regard to sustainability makes a significant impact on investment returns.

Hypothesis

I hypothesize that there will be more positive opinions about companies that are highly sustainable which will increase their stock prices during that time period. On the other hand, there will be more negative news and opinions about companies that are ranked low in sustainability which will decrease their stock price during that given time period.

Methods

My research centered around analyzing data on the Morningstar finance platform and the Twitter social media site. The first step was to collect the Twitter data through a social networking service scraper called snscrape and the pandas dataframe, a Python library used for working with datasets. I decided to use Python programming because it can be easily linked to Twitter's database and it is very useful for statistical and quantitative analysis. Through Python, I will gather relevant tweets. These tweets come from using the advanced search function on Twitter and putting in the keywords "ESG" and "each company name" within the time frame of the last 5 years (January 1, 2018 to January 1, 2023). I selected this time frame to effectively capture the impact of sustainability initiatives or violations implemented by companies which have impacted the US stock market. I have selected the top 3 companies by equity market capitalization in Vanguard FTSE Social Index Fund, an index fund composed of large and mid- cap stocks that are screened for environmental, social, and governance criteria. These companies were Apple, Microsoft, and Amazon. I then selected the top 3 companies by equity market capitalization in Vanguard Global Capital Cycles Fund, an index fund that generates high returns through investing in US and foreign securities, primarily in mining, basic materials, industrials and non-renewable energy extraction which go against the ESG values. These companies were Glencore, Schlumberger, and Barrick Gold. Schlumberger, Glencore, and Barrick Gold are all industry leaders in mining and energy extraction. I chose two well-known funds with long track records from the same investment management company to ensure that there were no extraneous variables that could affect the fund's performance. After collecting the tweets, I will analyze the sentiment polarity of these tweets through Python's sentiment analysis package.

Sentiment analysis is the process of evaluating opinions in text and the sentiment scores can be positive, neutral, or negative. Ariatis et. al (2022) discusses the importance of textual sentiment analysis in behavioral finance to quantify the behavior of financial entities of interest such as companies, financial markets, and commodities. On Python, sentiment analysis is done through Text Blob, a natural language processor. Python associates positive words with a score of up to +1 and negative words with a score up to -1. After each word in each tweet was analyzed, the data frame was cleaned through the preprocessing code I wrote. This got rid of any extraneous words like hashtags,

@ handles and any other missing words. Each data point/record also had a timestamp and the nearest hour. The sentiment analysis of tweets using Python allowed me to understand the overall nature and impact of these tweets.

After completing sentiment analysis, I focused on looking at the financial performance of the company's stocks on any given day. This information was found on the Morningstar finance website. I looked at the company's percent change in stock price per day for each company's given timeframe because it is the bet market metric to measure a company's financial performance and sustained growth (Murphy, 2022). I then calculated the correlation value between sentiment and stock price using Excel's correlation analysis tool. Finally, I constructed a double line graph (x-axis: Date, y- axis: sentiment score and stock price). After creating that graph, I would be able to see if the two variables (sentiment and stock price) follow any recognizable pattern or trends.

Turning Methods into Data Collection

From the FTSE Social Index Fund, I collected tweet data of Apple, Microsoft, and Amazon. On the other hand, from the Global Capital Cycles Fund, I retrieved tweets from Barrick Gold, Glencore, and Schlumberger. I collected the top 100 tweets selected based on the number of retweets they had for each company and then exported the data into an Excel spreadsheet. I decided to filter based on retweets rather than likes because it measures the popularity and visibility of tweets best on Twitter. The information including likes, retweets, raw content, and sentiment score for each tweet was also collected. I made sure to order the tweets based on date to see the progression of sentiment scores and I noted these dates down to match them with the financial data. In terms of the financial data, I collected information on the % change in stock price daily. Compiling all of the data in a chart gave me a robust framework to see whether the trends of sentiment score and % change of stock price followed each other. Below is an example of one of the six data charts I constructed.

Apple Data Chart

Date	Closing	Total	Total	Avg Sentiment	Avg Subjectivity	%Change
7-Nov-22	138.92	0	1	0.000	0.000	0.39%
8-Nov-22	139.5	75	9	0.000	0.500	0.42%
9-Nov-22	134.87	0	0	0.000	-	-3.32%
10-Nov-22	146.87	2	2	0.000	0.000	8.90%
11-Nov-22	149.7	0	0	0.000	-	1.93%
14-Nov-22	148.28	0	0	0.000	-	-0.95%
15-Nov-22	150.04	0	0	0.000	-	1.19%
16-Nov-22	148.79	0	0	0.000	-	-0.83%
17-Nov-22	150.72	5	3	0.600	0.800	1.30%
18-Nov-22	151.29	2	3	0.089	0.388	0.38%
21-Nov-22	148.01	0	0	0.000	-	-2.17%
22-Nov-22	150.18	1540	813	0.150	0.544	1.47%
23-Nov-22	151.07	5	6	0.000	0.000	0.59%
25-Nov-22	148.11	0	0	0.000	-	-1.96%
28-Nov-22	144.22	0	0	0.000	-	-2.63%
29-Nov-22	141.17	0	0	0.000	-	-2.11%
30-Nov-22	148.03	83	18	0.043	0.382	4.86%
1-Dec-22	148.31	9	4	0.294	0.450	0.19%
2-Dec-22	147.81	0	0	0.650	0.650	-0.34%
5-Dec-22	146.63	6	4	0.300	0.500	-0.80%

Date	Closing	Total	Total	Avg Sentiment	Avg Subjectivity	%Change
6-Dec-22	142.91	32	6	0.305	0.580	-2.54%
7-Dec-22	140.94	145	33	0.234	0.347	-1.38%
8-Dec-22	142.65	4103	830	0.308	0.493	1.21%
9-Dec-22	142.16	2099	522	0.363	0.414	-0.34%
12-Dec-22	144.49	22	19	-0.009	0.029	1.64%
13-Dec-22	145.47	104	15	0.171	0.629	0.68%
14-Dec-22	143.21	0	0	0.500	0.500	-1.55%
15-Dec-22	136.5	158	35	0.000	0.166	-4.69%
16-Dec-22	134.51	3	1	-0.300	0.500	-1.46%
19-Dec-22	132.37	1	2	0.147	0.300	-1.59%
20-Dec-22	132.3	0	0	0.800	0.750	-0.05%
21-Dec-22	135.45	12	5	0.764	0.653	2.38%
22-Dec-22	132.23	1	0	0.650	0.950	-2.38%
23-Dec-22	131.86	9	5	-0.089	0.172	-0.28%
27-Dec-22	130.03	0	0	0.000	-	-1.39%
28-Dec-22	126.04	0	0	0.000	-	-3.07%
29-Dec-22	129.61	0	0	0.000	-	2.83%
30-Dec-22	129.93	2	1	0.000	0.233	0.25%

Data Analysis

My preliminary analysis noted a few major patterns. First, the companies in the ESG fund are much more polarized in terms of sentiment because they contain companies that are more well-known. I think it also stems from the fact that companies like Apple and Amazon are set to a higher standard because they are regarded as sustainability leaders. Thus, there's often more backlash when they commit violations of ESG like treating their workers poorly or harming the environment through pollution. Secondly, although the companies in the non-ESG fund are industry leaders in oil and mining, the companies are less known and publicized. As a result, less tweets discuss their sustainability practices or place an emphasis on it. These companies are known for only pursuing high returns. Although they don't foster sustainability, they appear to not commit many negative ESG actions based on Twitter sentiment. It sheds light on what consumers and investors put emphasis on and really care about.

To put the sentiment analysis into perspective, I will display the top 3 tweets by retweets for the top company in each fund.

FTSE Social Index Fund (ESG Fund)

Apple

"CHINA - Foxconn iPhone factory. Workers broke out of Covid quarantine a few weeks ago, Foxconn has fired them all and cleared out everything they left behind. "- 812 retweets

"The current unrest in China started last week when blood was spilled on the iPhone factory floor. Now Apple is working with the CCP to restrict airdrops to stop protests.
Serious Q, what do the "S" and "G" in ESG really mean?
Vanguard's ESG U.S. Stock ETF largest holdings. https://t.co/F2u0HVxWZX "- 569 retweets

"Apple threatening to remove Twitter from the app store is another development in the ESG bloc of companies trembling and fear at the prospect of losing their narrative control.

By bringing back people once banished @elonmusk counters this power they had & it scares them. https://t.co/v7CbD8Sbhy"- 517 retweets

The three tweets listed above are fairly negative regarding Apple's practices. The tweets reference Apple's maltreatment of their workers and harmful labor practices which occurred during the timeframe of November to December 2022. Although these 3 tweets stand out in terms of bashing Apple, most of the other tweets did not have a similar negative connotation which is why the sentiment curve was not primarily in the negative region. This highlights that the negative tweets tend to be more discussed and relevant as they garner more retweets. In fact, the overall sentiment was leaning towards positive when discussing ESG which agrees with Novak et. al study on sentiment analysis of tweets. The stock price was fairly volatile during this period of time but didn't necessarily follow the sentiment trend. There was no strong correlation between percent (%) change in stock price and sentiment score as the correlation value for Apple was 0.02. However, I noticed a few similarities between the trends when looking at Apple's graph below. The sentiment score seemed to mimic the trend of the stock price with a gap of a few days. For example, the % change in stock price reached a peak on November 30 and sentiment seemed to peak on December 2. A similar pattern occurred when Apple stock price reached a low on December 15 and sentiment subsequently reached a low on December 16. This positive synergy can be attributed to the fact that investors were more favorable to Apple when it was performing well because it is a sustainability leader, but more critical when the company is performing worse because it is held to a higher standard. Over the course of one month, from the end of November to end of December, the trends followed each other.

Apple
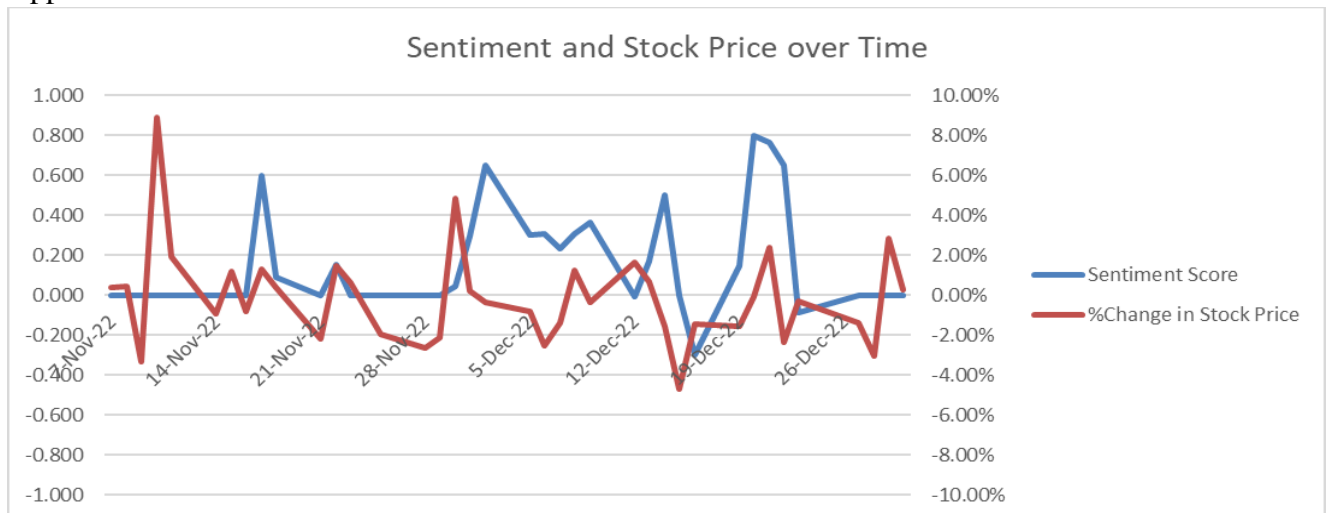
I conducted a similar analysis for Microsoft and Amazon, the other top companies in the ESG fund. The results were fairly similar to Apple. There was minimal correlation as the correlation value for Microsoft was -0.031 and the correlation score for Amazon was -0.046. However, the trend of sentiment and stock price that I noticed in Apple's graph was not replicable in the other two graphs. This means that the trend is more specific to Apple especially during the time period of high-volume tweets (November- December 2022).

Microsoft
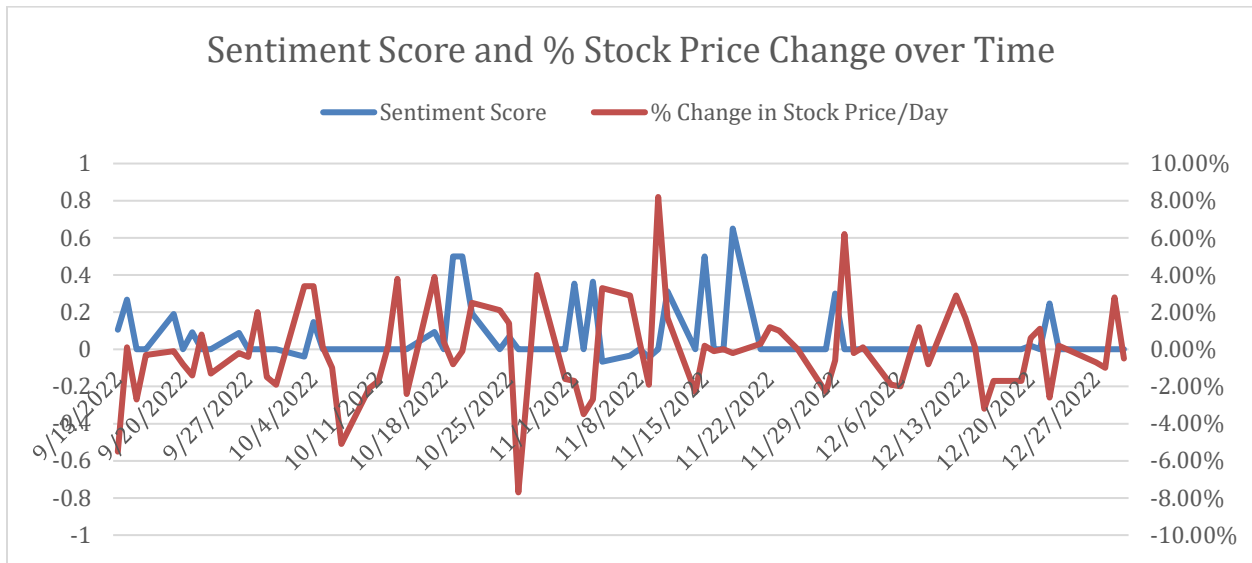
Amazon
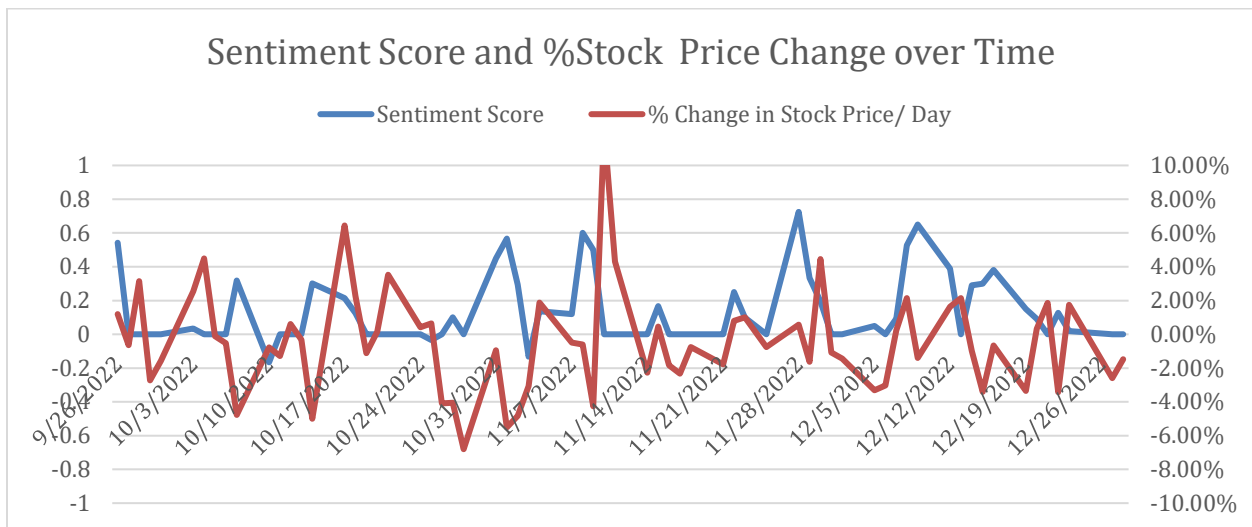
Global Capital Cycles Fund (Non-ESG Fund)

On the other hand, the non-ESG fund had less tweets in terms of high likes and retweets yet a stronger correlation. One of the trending companies in the non-ESG fund was Schlumberger. It had a negative correlation value of -0.218, meaning that there is a fairly weak negative correlation. Below are a couple of the tweets with the most retweets.

"Fascinating to me that the largest ESG ETF in the world $ESGU (now up to $16b) owns Exxon, Chevron, ConocoPhillips, Schlumberger etc. And pretty much at same weightings as SPX, an in a few cases a touch more. https://t.co/lT66Gu35Dg"- 73 retweets

"OIL SECTOR HEADS FOR BEST MARGINS SINCE 2008, SCHLUMBERGER SAYS
Meanwhile, ESG investors: https://t.co/MbaOgGqjuo"- 73 retweets

"Companies resisting Russia-exit will eventually have to leave as the ESG risks are much higher than anything they can make in the declining Ru market. @Halliburton @Schlumberger @bakerhughesco crucial for Ru energy sector announced exit. #BoycottRussia \https://t.co/LpOTIELMe4"- 38 retweets

There are a couple of key findings from Schlumberger that reflect the non-ESG fund. First, the tweets for the companies in the non-ESG funds are much less visible because these companies are less mainstream. Although Schlumberger is known for its lack of sustainable actions, Twitter users don't seem to negatively speak out about the company, rather they emphasize the hypocrisy of the ESG ideal. This shows that companies like Schlumberger are less polarizing, and investors don't react as strongly to news regarding their sustainability practices.

The graph below shows how the sentiment(blue) is generally in the positive range and the highest it reaches is around 0.5. This can be partly attributed to the fact Schlumberger is less widely followed by the retail investors. However, it also shows that the companies in the ESG fund aren't necessarily committing actions that are destructive towards environmental or social standards. In fact, these energy-dominant companies are slowly taking steps to be more environmentally friendly and promote diversity within the firm.
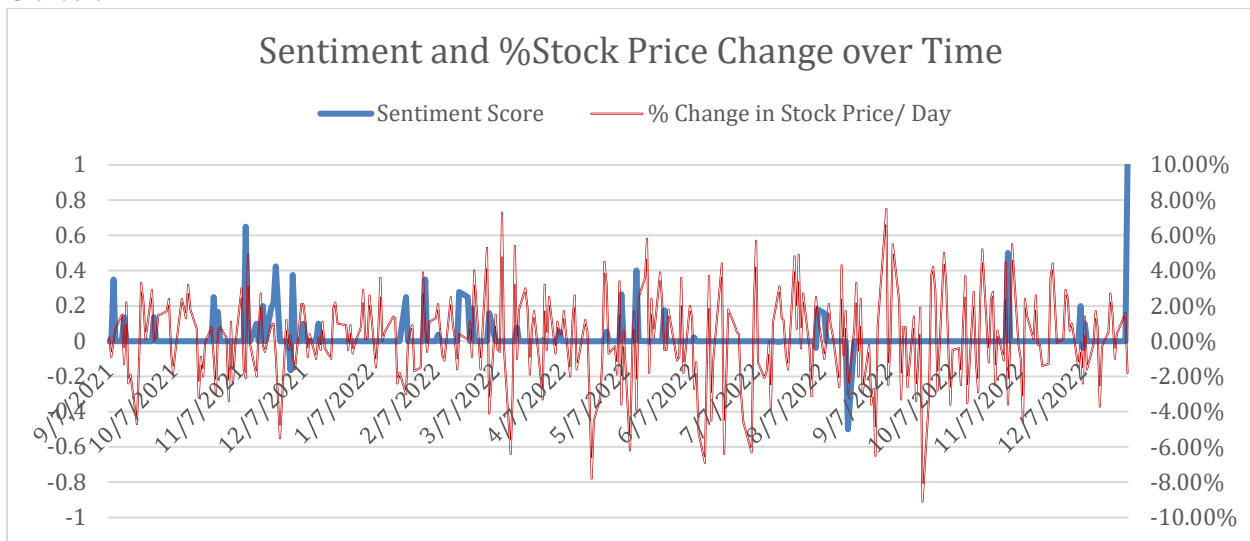
Schlumberger
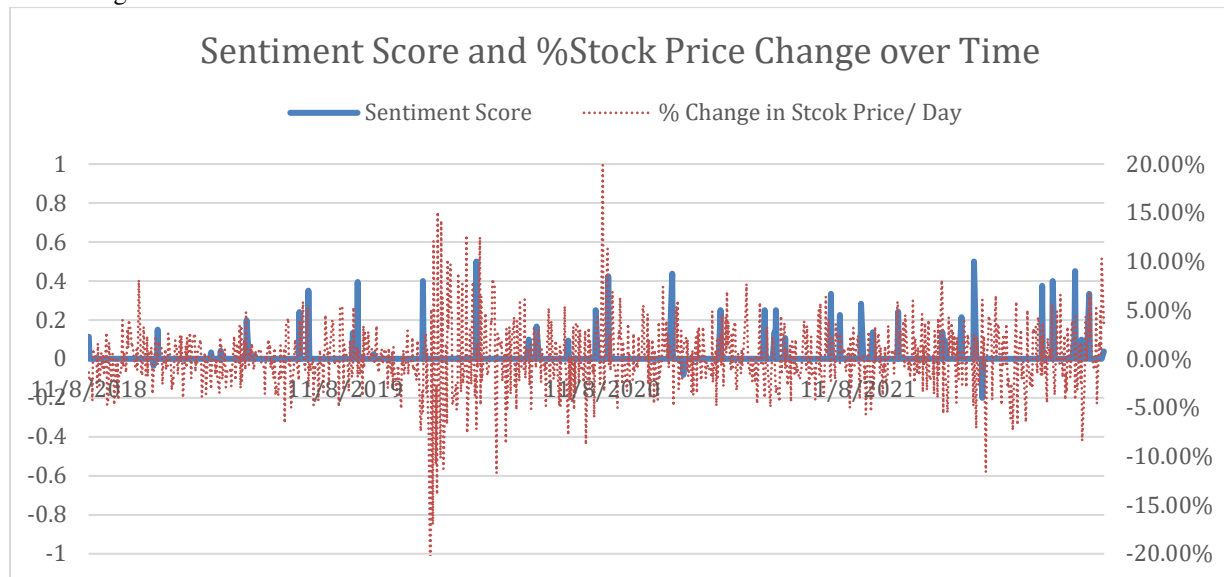
Barrick Gold and Glencore also had similar trends. The correlation value for Barrick Gold was 0.256 and the correlation value for Glencore was -0.275. This shows that there was not a strong correlation between sentiment scores and % stock price change/day for these companies as well.

Barrick Gold
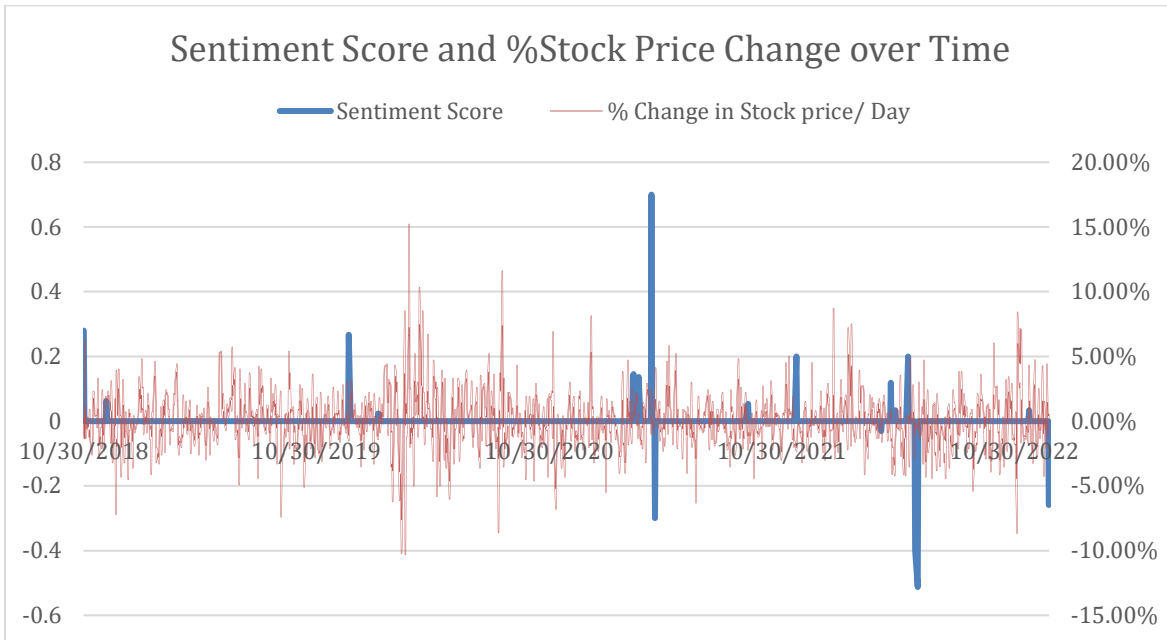
Glencore

Conclusions & Implications

As a whole, the sentiment of tweets can be a misrepresentation of how a company is performing financially. For the six companies I analyzed, none of them had a strong correlation between sentiment score and percent change in stock price, showing that tweets about sustainability practice doesn't necessarily sway stock prices. This goes against the findings by Liu et. al (2023) where they conclude that there is an overall weak but significant positive synergy(correlation) between stock prices and investor sentiment meaning that although both variables tend to go up in response to each other, the relationship is not very strong. The only company in my analysis that fits the weak positive correlation finding was Apple from the end of November to end of December in 2022. The study does qualify their finding, stating that this synergy may be reversed or even disappear during short intervals of time like the time periods during the

Shanghai and Wuhan lockdowns. This supported my findings where there did not appear to be any significant correlation between sentiment score and stock price change per day over the time period of high-volume tweets for each company.

Secondly, I noticed that negative opinions on well-known companies get more likes and retweets; but don't reflect the nature of the company as a whole. This was very evident when analyzing companies like Apple and Amazon that are very polarizing to the public. Even though they are part of the ESG fund which contains companies that avoid backlash and pursue sustainability, the majority of tweets discussed the controversies surrounding these companies. This shows that people tend to gravitate towards the negative storylines and scrutinize the ESG companies more. In a sense, they are held to a higher standard and are expected to perform better in their initiatives. This idea could be an area of future study looking at why negative opinions tend to rise and relate more to investors, specifically examining the psychological aspects of behavioral finance.

Reflecting on Berg et. al study that showed there is a lack of consistency in ESG ratings, ESG performance is then less likely to be reflected in corporate stock and bond prices, as investors face a challenge when trying to identify outperformers and laggards. This connects to my research because Twitter investors may evaluate the ESG and non-ESG companies in different ways which would reflect in their tweet opinions and sentiment. Even if the majority of investors are positive towards ESG performance, the divergence of ratings can alter the effect of preferences on stock prices. This poses as another reason why there was a minimal correlation between sentiment score and stock prices.

Lastly, I concluded that sentiment analysis may not be a fully accurate way of capturing public perception as it doesn't detect sarcasm or irony. Certain tweets would mention that Apple/Microsoft/Amazon were ESG leaders and then make a comment about why they are overrated and how they are not environmentally or socially conscious. However, the programming would give that a positive score even though the intent of the tweet was to criticize the company. This means that not all of the tweets were accurately captured in terms of their intent to sway the public and there could be a positive skew in sentiment score. Future sentiment algorithms using AI and machine learning capabilities can address this shortcoming in sentiment analysis.

To improve this aspect, future research could conduct topic modeling to forecast price movements and strengthen the validity of the sentiment analysis. (Ariatis 2022) This would give a clearer understanding of the reasons investors prefer or dislike these companies. Topic modeling would also reveal other aspects of a company like their political affiliations or international affairs that could be reflected in changes in their stock prices.

Ultimately, my research study shows that while social media sentiment isn't always an accurate predictor or influencer of the stock price performance of companies, Twitter and other media platforms can reflect current trends, fads, and a range of investor opinions as it relates to investing in publicly traded companies.

References

Arratia, A., Avalos, G., Cabaña, A., Duarte-López, A., & Renedo-Mirambell, M. (2021). Sentiment analysis of Financial News: Mechanics and Statistics. Data Science for Economics and Finance. https://doi.org/10.1007/978-3-030-66891-4_9

Atkins, B. (2020). Demystifying ESG: Its History and Current Status. Forbes. https://www.forbes.com/sites/betsyatkins/2020/06/08/demystifying-esgits-history--current-status/?sh=14d126392cdd

Berg, F., Kolbel, J.F., Rigobon, R. (2022). Aggregate Confusion: The Divergence of ESG Ratings. *Review of Finance, 26(6)*. https://doi.org/10.1093/rof/rfac033

Boffo, R., & R. Patalano (2020). ESG Investing: Practices, Progress and Challenges. *OECD Paris*. www.oecd.org/finance/ESG-Investing-Practices-Progress-and-Challenges.pdf

Briehl, S. (2022). Behavioral biases in ESG investing. GRIN. https://www.grin.com/document/1189888

Crace, L., & Gehman, J. (2022). What Really Explains ESG Performance? Disentangling the Asymmetrical Drivers of the Triple Bottom Line. Sage Journals, 36(1). https://doi.org/10.1177/10860266221079408

Dure, E. (2021). Social media's influence on the investing community. https://www.chase.com/personal/investments/learning-and-insights/article/social-medias-influence-on-the-investing-community

Efimova, O. (2018). Integrating sustainability issues into investment decision evaluation. Journal of Reviews on Global Economics, 7. https://www.academia.edu/72386459/Integrating_Sustainability_Issues_into_Investment_Decision_Evaluation

Horton, C. & Jessop, S. (2022). Positive ESG performance improves returns globally, research shows. Reuters. https://www.reuters.com/business/sustainable-business/positive-esg-performance-improves-returns-globally-research-shows-2022-07-28/

Kishan, S., Moran, D., Marques, F. (2022). BlackRock Faces $2 Billion Hit as DeSantis Escalates ESG Fight. https://www.bloomberg.com/news/articles/2022-12-02/blackrock-faces-2-billion-hit-as-desantis-escalates-esg-fight#xj4y7vzkg

Lee, M., & Suh, I. (2022). Understanding the effects of environment, social, and governance conduct on financial performance: Arguments for a process and integrated modeling approach. Sustainable Technology and Entrepreneurship, 1(1). https://doi.org/10.1016/j.stae.2022.100004

Liu, O., Lee, W., Huang, M., Wu, O. (2023). Synergy between stock prices and investor sentiment in social media. Borsa Istanbul Review, 23(1). https://doi.org/10.1016/j.bir.2022.09.006

Lyon, T. P. &; Montgomery, A. W. (2013). Tweetjacked: The impact of social media on corporate Greenwash. Journal of Business Ethics, 118. https://doi.org/10.1007/s10551-013-1958-x

Murphy, C. (2022). Why Do Companies Care About Their Stock Prices? *Investopedia*. https://www.investopedia.com/investing/why-do-companies-care-about-their-stock-prices/

Novak, P., Amicis, L. & Mozetič, I. (2018). Impact investing market on Twitter: influential users and communities. Appl Network Science, 3(40). https://doi.org/10.1007/s41109-018-0097-9

Team, T. I. (2023). What is environmental, social, and governance (ESG) investing? *Investopedia*. https://www.investopedia.com/terms/e/environmental-social-and-governance-esg-criteria.asp

World Health Organization (n.d.). Sustainable Development Goals. https://www.who.int/europe/about-us/our-work/sustainable-development-goals