The Power of Internet Investors: The Case of GameStop

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Introduction

The Covid pandemic has led to a significant increase in time spent on the internet for many people. With trading platforms like Robinhood giving the Average Joe easy access to the financial market, there was a spike in individual investors trading stocks, bonds, ETFs, and other financial derivatives online. Alongside the uptick in trading volume came the formation of various trading communities. One of the most prominent communities is r/wallstreetbets, a Reddit Forum aimed at bankrupting profit-reaping hedge funds and choosing the next best stocks to pump for win-win deals within the community.

In late January 2021, GameStop (GME), an American video game, consumer electronics, and gaming merchandise retailer that is currently the largest video game retailer worldwide, got short-squeezed primarily due to investors on r/wallstreetbets posing that they would take over GameStop. What started as a joke turned serious as this idea soon evolved into punishing short-sellers and turning into a movement that lets the little guys pummel Wall Street. A well-known active investor named Keith Gill provided in-depth posts that detailed his idea behind investing in GameStop, posting screenshots of his position: 50,000 shares of GME. His dedication to the stock convinced other members on Reddit to invest. As the stock surged, hedge funds that shorted (betted against) the stock had three options: hold the position, buy back the shares and take a loss, or sell more of the shares to reduce risk.

Community members in the r/wallstreetbets forum started to buy the stock aggressively, which pushed the stock price up. Many short sellers started to cover their short position by buying the shares back at a loss. This much buying pressure drove stock prices up, leading to more short sellers buying back the shares to cover their position, and the cycle continues.

I hypothesize that negative sentiment posts on Reddit do not affect the stock price while positive sentiment posts positively drive the stock price up. This is because when investors see positive posts, they want to jump onto the bandwagon to reap the profits, but when they see negative sentiment posts, they view the stock as having a low cost of entry so they purchase it anyway. Testing this hypothesis is important not only in terms of designing a policy that deters positive sentiment posts such as profit-sharing, but also examining the psychology behind individual investors.

Methodology

To examine the effects of r/wallstreetbets on GameStop, analyzing comparable companies to GameStop would isolate the effect of the Reddit forum, providing evidence that posts regarding GameStop influence the stock price. Since it is unnecessary to select a universe of stocks for comparison, I selected three companies that are related to GameStop but not mentioned at all in r/wallstreetbets during the short squeeze. In direct competition with GameStop, JB Hi-Fi Limited (JBH) is an Australian consumer electronics, publicly listed on the Australian Securities Exchange; Best Buy Co. Inc. is an American multinational consumer electronics retailer, publicly listed on the New York Stock Exchange; Nintendo Co., Ltd. is a Japanese multinational video game company, publicly listed on the New York Stock Exchange. The three companies are selected based on their high operational correlation with GameStop's business model, a gaming merchandise and consumer electronics retailer. All three companies have a strong presence in these markets in their respective countries, so they are highly correlated comparable companies.

To quantify the effect of r/wallstreetbets on GameStop, I conducted a side-by-side comparison of GameStop and the three comparables' stock prices respectively to isolate the effect of the Reddit Forum alone on GameStop, producing quantitative figures that measure the impact of this short squeeze event.

To test my hypothesis, I compared the sentiment on a day-by-day basis by examining the movement of the stock closing price on that day against the previous day. If the sentiment value

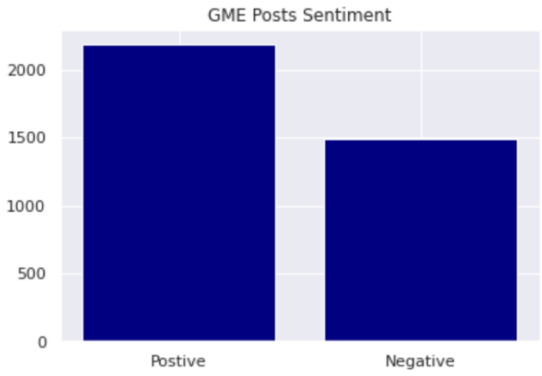
is above zero, I categorized it as a positive sentiment day; likewise, If the sentiment value is below zero, I categorized it as a negative sentiment day. If my hypothesis is correct, negative sentiment days would not correlate to a decrease in the stock closing price from the previous day but positive sentiment days would correlate to an increase in the stock closing price from the previous day.

In order to calculate the sentiment score, I utilized Textblob in the Python NLP library [4]. When a sentence is passed into Textblob two outputs are returned: polarity and subjectivity. Polarity is the output that lies between [-1,1], where -1 refers to negative sentiment and +1 refers to positive sentiment. Subjectivity is the output that lies within [0,1] and refers to personal opinions and judgments. I only focused on the first output to carry out sentiment analysis. Textblob's artificially intelligent bots are trained on millions of pieces of text to detect if a message is positive, negative, or neutral. When computing a sentiment for a sentence, TextBlob employs the "averaging" technique, which extracts the polarity values from its library to calculate a polarity score for a single word and repeats the procedure to apply it to every single word, resulting in a combined polarity for larger texts [4]. Furthermore, Textblob ignores any stop words i.e., the, he, have, etc. because they do not have any sentiment and handle negations by multiplying the polarity by -0.5.

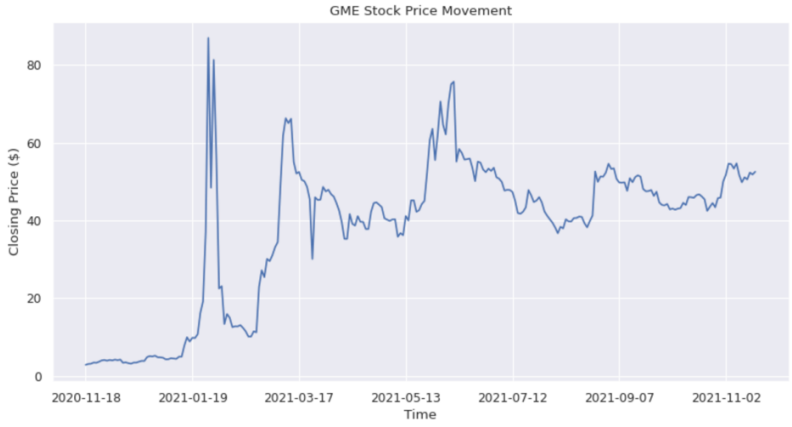
Data Collection and Statistics

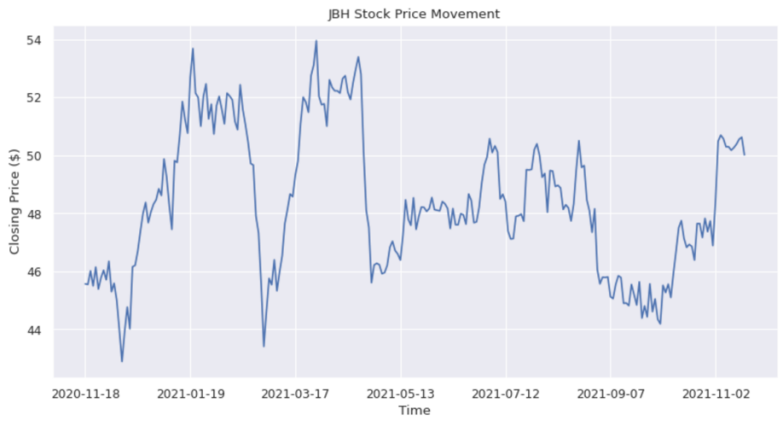
There are five dataset collections for the data analysis: Reddit posts CSV file, GameStop daily closing stock price, JBH daily closing stock price, BestBuy daily closing stock price, and Nintendo daily closing stock price. I collected the Reddit text posts dataset as a CSV file from Kaggle, which consists of all user posts published on the Reddit forum r/wallstreetbets from September 28th, 2020 to August 16th, 2021 [5]. I downloaded all the closing stock price data for each company from Yahoo Finance with the timeframe ranging from November 18th, 2020 to November 18th, 2021. I selected the timeframe that captures at least one month before and one month after the GameStop short event for all the stock price data, overlapping with the majority of the Reddit dataset, which ranges from November 18th, 2020 to August 16th, 2021.

I've first looked at the direction of the sentiment of the Reddit posts on GME, with around 700 more positive posts about GME than negative ones. The figure below shows that overall sentiment of GameStop within the selected time period is positive.



Next, I output the stock price movement of GME as well as JBH (the comparable company).

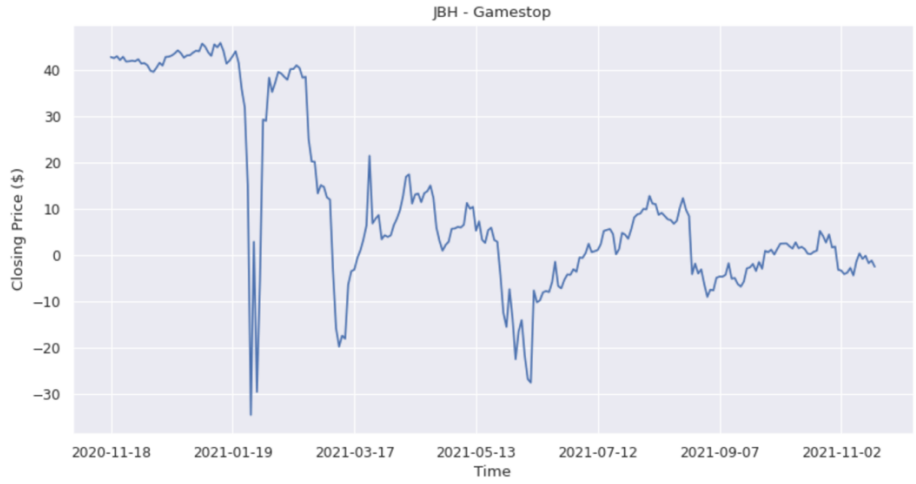




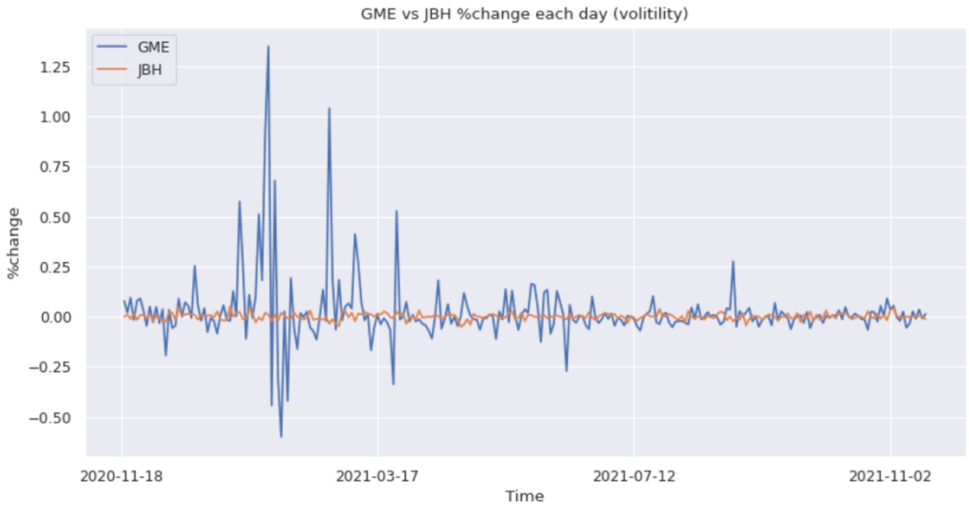
At first glance, JBH's stock price looks very volatile, so I readjusted the y-axis to match that of GME's chart, showing that it's relatively stable compared to GME.

To examine the difference between JBH's and GME's stock prices, I've subtracted GME's daily closing stock price from JBH's daily closing stock price in the same timeframe for each day the

stock market is open. If GameStop hasn't been subjected to the short squeeze, you would expect the start of the line to continue until the end of the graph, but we see a sudden dip, even going to negative 30 as GME's stock price surpassed JBH's stock price. We see this effect lasting all the way until the end of our examined timeframe.



Since the graph above is in absolute values, I normalized the stock prices by taking the percent change of the stock price from the previous day and graphed GME's %change to JBH's % change, which showcases the volatility of the stocks. We can clearly see that GME was relativity stable until the short squeeze in January 2021, with the effect rippling out in time; JBH was more stable than GME by a huge margin within our timeframe



In order to calculate a quantitative figure that showcases the short squeeze event has a correlation to the stock being volatile, we can calculate the volatility of the stocks by taking the standard deviation of its %change each day times by the number of trading day periods. We would expect to see a significantly higher volatility figure for GameStop than for JBH.

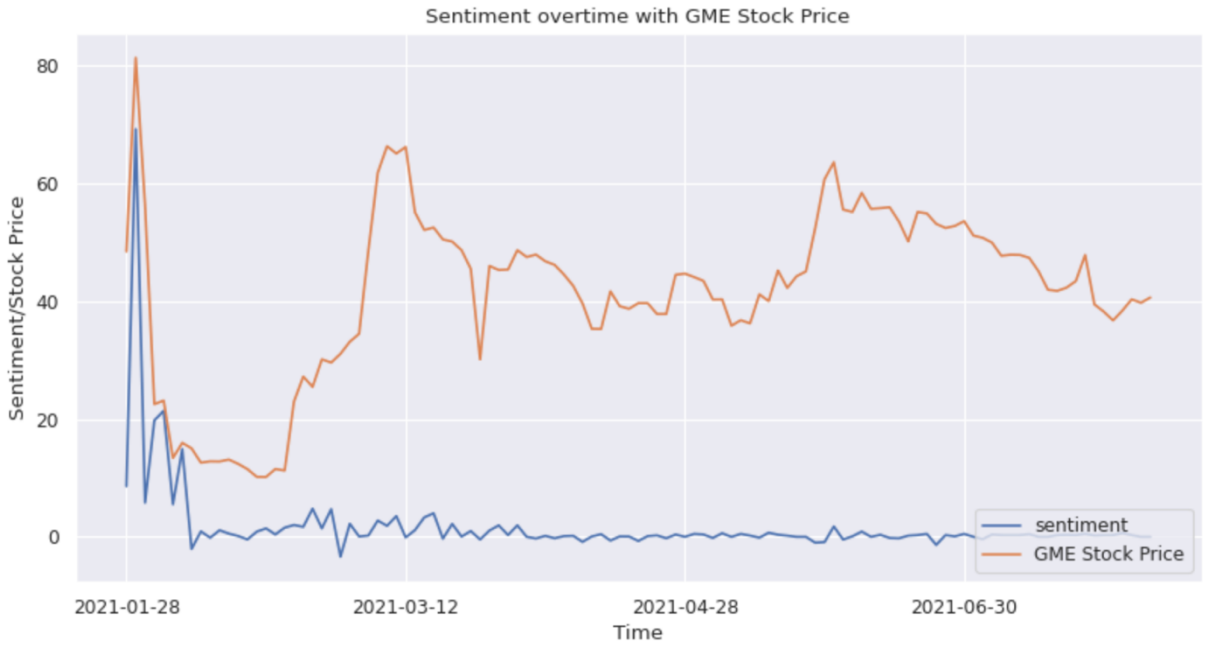
Volatility Comparison	
Company	**Volatility (per annum)**
GME	42.9
JBH	4.1
BB	4.9
Nintendo	4.7

Table 1 - Summary Statistics

As shown, GameStop's volatility score within our timeframe is roughly 42.89, whereas JBH's volatility score is roughly 4.1, more than 10 times less volatility than GameStop's (Table 1). It is clear from above that GameStop has been subjected to drastic volatilities and fluctuations compared to our control company, with most of the volatility subjected to the influence of Reddit because the volatility of GameStop before and after the event is low but only high (as shown in the volatility graph) when individuals investors started to create a bubble on the stock. To further prove this statement, I carried out the same analysis on the two other control companies.

As shown in the figures above, the volatility values of BestBuy (4.9) and Nintendo (4.7) are both significantly lower than GameStop, further providing evidence that the stock was subjected to manipulation during our selected timeframe (Table 1). After establishing the quantitative figures

that showcase the volatility of GameStop compared to its comparable companies, I examined the correlation between GameStop's sentiment each day and its respective daily stock closing price.



At the beginning of the graph, there seems to be a high correlation between sentiment value and GameStop's closing price. To test the hypothesis, I not only needed to examine the correlation but also have to separately look at positive sentiment days and negative sentiment days. If my hypothesis is correct, for positive sentiment days I will observe a higher stock closing price than the trading day before and for negative sentiment days, I will observe that the stock closing price does not drop lower than the previous trading day.

RESULTS

I separated out the dataset into net positive sentiment and net negative sentiment days. By taking the average of the %change respectively in the net positive and negative data frames, we can test the hypothesis: negative sentiment posts on Reddit do not affect the stock price while positive sentiment posts positively drive the stock price up.

As shown in the results, the average %change in the net positive data frame is positive, 0.012 (1.2% increase in stock price from the baseline of the first trading day), and the average %change in the net negative data frame is negative, -0.0155 (1.5% decrease in stock price from the baseline of the first trading day) (Table 2). We would reject the first part of the hypothesis and fail to reject the second part of the hypothesis according to these results. On the net positive sentiment days, we observed an average increase in stock price, suggesting a correlation between Reddit sentiment and stock price. On the net negative sentiment days, we observed an average decrease in stock price, also suggesting a correlation between Reddit sentiment and stock price.

However, stock prices have momentums and yesterday's stock price might carry over to the next day's stock closing price. To address this problem, instead of looking at whether it is a net positive sentiment day or not (sentiment value greater than or less than 0), I looked at whether the sentiment value is greater than or less than the average sentiment across our selected timeframe. By examining whether the sentiment value on a particular day is above or below average sentiment of our selected timeframe, I essentially standardized the sentiment value and removed the effect of momentum, giving us a more accurate analysis for testing the hypothesis.

Average GME Stock Movement from Baseline (%change)		
	Positive	**Negative**
Raw	0.012	-0.02
Benchmarked	0.06	0

Table 2 - Summary Statistics

As shown above, the average %change in the above-average data frame is positive, 0.055 (5.5% increase in stock price from the sentimental average), and the average %change in the below-average data frame is negligible - 0.0000211, roughly 0.00211% increase in stock price from the sentimental average (Table 2). We would fail to reject the hypothesis according to these results.

Draft Literature Review

In the paper “Wall Street vs r/wallstreetbets: Exploring the Predictive Power of Retail Investors on Equity Prices,” they found that it is easy to make substantial returns executing trades on Tesla stocks based on a formulation that draws on semantic learnings from r/wallstreetbets posts [1]. This arguably speaks to the power and influence of the average, non-institutional trader that drives stock prices through online forums. Establishing that individual traders have enough power to influence the stability of the market, I wanted to explore the difference between trading patterns between individual and institutional investors.

The second paper I explored tried to answer the question “Who is the more overconfident trader? Individual vs. institutional investors” [2]. They found that both individual and institutional investors tend to trade more aggressively after market gains during bull markets, up-state markets, and up-momentum market states and that only individual investors trade more in riskier securities aftermarket gains, so market gains make individual investors trade more actively in subsequent periods than institutional investors. This could potentially explain the sudden uproar in GME stocks as individual investors poured in after the up-momentum market posts on the Reddit forum. Given the “snowball effect” of individual traders piling on a stock that has been hyped up, what happens to the various stakeholders associated with that stock?

The third paper I read was “We Reddit in a Forum: The Influence of Message Boards on Firm Stability” [3]. Their results present substantial evidence that the group can generate not only abnormal returns but also significant volatility effects along with widespread instability. The group r/wallstreetbets has an anti-hedge fund mission, so by pushing the stock price on GME which the hedge funds shorted, major hedge funds such as Melvin lost $6.8 Billion in a month.

The added dimension of a group equally content with generating disruption and financial destruction and with generating losses correctly generates anxiety among regulators, policymakers, and governments alike. In addition, this event is different from the dot-com collapse in that the forum has a global scale, the information transfer is immediate, the leveraged derivative trading accounts have a broad availability, and the algorithm trading and systems can instantly respond to momentum and positional movement.

CONCLUSION

As shown in the results, we failed to reject the hypothesis. On the above-average sentiment days, we observed an average increase (stronger than the first hypothesis test) in stock price, suggesting a correlation between Reddit sentiment and stock price. On the below-average sentiment days, we observed a negligible change in stock price, also suggesting no correlation between negative sentiment posts and stock price.

The observations from the sentiment analysis shine a light on stock market bubbles, where only positive sentiments affect the stock and negative sentiment rarely budge consumer sentiment, inflating the value of stocks much more than negative sentiments deflating them. However, from real-world observations, we do see bubbles bursting that led to dramatic stock price declines, so the results of the paper are only applicable to the formation of the bubble before the burst. We also gain certain insights into the psychology of individual investors: they want stocks to rise to make money or simply want to bring down big hedge funds, so they utilize the power of the internet to create bubbles – but we rarely see posts on reaping profits through shorting a stock, as this may be viewed as behavior similar to hedge funds, which are generally dismissed in r/wallstreetbets.

To prevent amateur investors from pumping up stock prices, imploding the bubble, then reaping a profit before the bubbles burst, platforms like Reddit should display warning signs on the Home Page of stock-related communities, reminding users of the risks in stock investments and taking advice from internet strangers for granted without carrying our analysis or making a judgment call themselves.

Citations

[1] Gupta, Anshul. “Wall Street vs r/Wallstreetbets: Exploring the Predictive Power of Retail Investors on Equity Prices.” *Stanford University*, https://web.stanford.edu/class/archive/cs/cs224n/cs224n.1214/reports/final_summaries/summary010.html.

[2] Susmel, Rauli. *Who Is the More Overconfident Trader? Individual vs. Institutional ...* https://www.researchgate.net/publication/222828742_Who_is_the_More_Overconfident_Trader_Individual_vs_Institutional_Investors.

[3] Corbet, Shaen, et al. “We Reddit in a Forum: The Influence of Messaging Boards on Firm Stability.” *SSRN*, 17 Mar. 2021, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3776445.

[4] "How To Obtain A Sentiment Score For A Sentence Using TextBlob." Analytics India Magazine, 8 Mar. 2021, https://analyticsindiamag.com/how-to-obtain-a-sentiment-score-for-a-sentence-using-textblob/.

[5] Preda, Gabriel. "Reddit WallStreetBets Posts." Kaggle, 2021, https://www.kaggle.com/datasets/gpreda/reddit-wallstreetsbets-posts.