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Will the reddit rebellion take you to the moon? Evidence from WallStreetBets

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Abstract:

In early 2021, several stocks receiving attention from retail traders known as "meme stocks" soared in value. A primary source of information regarding these stocks comes from the social media platform Reddit, specifically from a subreddit known as WallStreetBets (WSB). This paper investigates whether a simple and easily implementable trading strategy following the WallStreetBets (WSB) subreddit can produce alpha. We document no evidence this is the case. Though we do observe a positive relation between WSB submissions and abnormal trading volume, we find that a portfolio that goes long buy recommendations and short sell recommendations each day is not profitable on a risk-adjusted basis. Holding periods from one day to one year fail to produce alpha. These findings are robust to a variety of different portfolio formation strategies. Our results provide an early look at the data following the explosion of interest in social media inspired retail investing.

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1. Introduction

Individual investors have greater access to financial markets than ever before. Historically, retail investors with four or five digit investment accounts would need to aggregate their capital into a professionally managed fund in order to impact equity markets. In recent times, retail investors have begun banding together through the use of online social platforms and executing strategies like short squeezes and gamma squeezes. It is undeniable that these groups, perhaps the most famous of which is the subreddit thread "WallStreetBets" (WSB), have had a material impact on certain stocks and commodities such as GameStop, AMC Theatres, and Silver. It is less obvious, however, whether these groups can consistently produce a profitable trading strategy for their followers. In this paper, we aim to address this very question.

A unique sequence of events has led to significantly increased interest in stock and option trading by retail investors. First, Robinhood, a retail broker whose mission is to "democratize finance for all" introduced zero commission stock trading and easy to access options trading.[1] This ultimately led to a "race to zero" from other major brokers. Second, the COVID-19 pandemic caused non-essential workers to largely remain at home for most of 2020, leading to lower consumer spending and greater time to pursue alternative ventures. Finally, the largest monetary and fiscal stimulus packages to ever occur led to a significant increase in the amount of cash in retail investors' hands. According to Barron's analysis of data from the Bureau of Economic Analysis (BEA), Americans have saved about $1.8 trillion more than they otherwise would have

[1] https://robinhood.com/us/en/support/articles/our-mission/

since the pandemic begun (Barron's, 2021). This unique combination of lower trading frictions, more time, and greater capital has led to a boom in retail accounts.[2]

In this paper, we investigate whether a trading strategy that follows the WSB subreddit can consistently produce alpha. The literature to date has been mixed regarding whether individual opinions posted to social media are informative for stock prices. Two examples include Philipp and von Nitzsch. (2013) who find no evidence of information content in aggregated recommendations and Chen et al. (2014) who find online opinions can predict stock returns.

Our approach is unique because rather than examining how opinions on a given forum can predict individual stock prices, we focus on whether a simple and easily implementable trading strategy following WSB can produce alpha. Our perspective is that of a typical retail trader that uses the WSB thread to make stock picks. As evidenced by the creation of the VanEck Vectors Social Sentiment ETF (ticker BUZZ) which tracks the 75 large U.S. stocks with the most bullish perception from social media and other alternative datasets, there appears to be interest in such a trading strategy.

We scrape buy and sell submissions from the WSB subreddit from its inception in 2012 through the first quarter of 2021 when the GameStop short squeeze occurred. We then form a daily rebalancing long-short portfolio that goes long "buy" suggestions and short "sell" suggestions, where the suggested stocks can be held for one day, one week, one month, or one year. We find no evidence of a profitable trading strategy. We examine various alternative portfolio formation strategies and the result is robust.

[2] Other factors likely contributing to retail interest in trading are larger than typical stock returns following March 2020 and the significant growth of cryptocurrencies. However, the direction of causality is not obvious and likely dynamic.

A large literature documents the effect of investor sentiment on asset prices (Baker and Wurgler, 2007; Stambaugh et al., 2012, among many others). Kumar and Lee (2006) document evidence that retail traders are specifically impacted by investor sentiment. Given the nature of the WSB thread and its rise to fame following widespread bullish sentiment on meme stocks like GME and AMC, we consider whether returns to portfolios following the thread are impacted by market sentiment. A popular and simple method for estimating investor sentiment is the put-call ratio (Bandopadhyaya and Jones 2006 and 2008). It is plausible that WSB investors are profitable on days with strong investor sentiment because meme stock trades may outperform on those days. We test whether there is any difference in performance on bullish or bearish days, however, in all days, alpha continues to be nonexistent.

We next examine whether there exists a relation between trading activity and WSB submissions. Loh and Stulz (2011) and Chacon et al. (2020), among others, use abnormal turnover as a measure of whether analyst recommendations induce trading. We apply a similar framework to WSB submissions and find there is significant abnormal turnover surrounding the typical WSB submission. This finding suggests, consistent with anecdotal evidence, that investors do indeed track and trade on WSB submission information.

Finally, although our goal is to evaluate a simple trading strategy, we recognize there is likely heterogeneity of skill across posters. To this end, we identify the top 40 posters by submission volume and examine their individual performance. For this set of tests, we examine the two day trading window following the buy or sell submission. We find a wide range of performance across the top 40 posters, ranging from an average of 14.86% long-short cumulative abnormal returns (CAR) to a -14.73% long-short CAR. CARs are measured as benchmark adjusted returns where the benchmark model is the Fama French 5 factor model plus momentum (Fama and

French, 2015). Interestingly, the average long-short CAR for the top 40 posters is 0.25% and the median is -0.38%, both very close to 0.

It is important to note that our results do not indicate that one cannot profit from advice on WSB or that no WSB posters are informed. Certainly, there were great successes by the early investors in GameStop and there are examples of detailed and quality stock analysis. Rather, the objective of our paper is to take an early look at a simple and easily implementable trading strategy that follows trading advice from WSB subreddit and evaluate the strategy's performance over time.

Our paper contributes to the growing literature on retail trading and specifically the impact of social media on retail trading activities. The early literature has generally found individual investors to be uninformed traders. Perhaps the most notable example is Barber and Odean (2000) who find trading is hazardous to retail traders' wealth. More recent research has been more positive on retail trading skill. One of several examples includes Boehmer et al. (2021) who find stocks with strong buying from retail outperform stocks with strong selling.

New research on the topic is critical because the landscape for retail investment is shifting. With the cost of information decreasing exponentially and the cost of active trading approaching zero, significant frictions are dissipating in the current environment. Another notable difference is the generation of traders using WSB is generally thought to be new to the market. How this generation performs relative to past generations is interesting. Whether the new generation of retail traders can succeed in the more favorable environment is an important research question we aim to address. One avenue by which the costs of information has decreased is the rise of social media platforms to exchange ideas. The literature to date has been mixed whether opinions on these social media platforms can predict stock returns. Our study contributes to this literature by focusing on a

trading strategy that can be easily implementable by a retail investor and observing how that investor would perform.

The remainder of the paper is organized as follows: section 2 reviews the relevant literature, section 3 descries the data and empirical methods utilized in the study, section 4 presents the results, section 5 presents robustness tests, and section 6 concludes.

2. Literature Review

Two strands of relevant literature focus on retail trading performance and the impact of social media on financial markets. The retail trading performance literature is broad and mixed, with early findings generally documenting a lack of skill of retail investors (see Barber and Odean 2013 for an excellent review). Barber and Odean (2000) document utilize retail trading account data and find that households tend to underperform the market, and those who trade actively are the greatest underperformers. The authors have a stream of future papers that document further retail underperformance across time and geography. One example is Barber et al. (2009) who analyze the trading records of Taiwanese investors and document underperformance.

However, the aforementioned studies mostly focus on long term performance. In our setting, traders tend to have shorter horizons. Studies focused on shorter horizons tend to document more evidence of success for the retail investor. For example, Kaniel et al. (2008) show the retail investor trading positively predicts short term returns. Kaniel et al. (2012) find similar results of informed trading around earnings announcements. Similarly, Barber et al. (2009) documents that stocks heavily bought in retail books positively predict performance. Boehmer et al. (2021) document retail skill over a week long horizon. Other papers focus on subsets of retail investors.

For example, Fong et al. (2014) find that trades of full service brokers outperform those of discount brokers.

Another strand of literature focuses specifically on social media based investment advice for retail investors. Papers have focused on different social media outlets including Motley Fool (Hirschey et al. 2000), Raging Bull (Tumarkin and Whitelaw, 2001; Antweiler and Frank, 2004), Yahoo! Finance (Kim and Kim, 2014), Twitter (Giannini et al., 2018; Garcia, 2021; Bartov et al. 2018), Seeking Alpha (Chen et. al, 2014), SumZero (Crawford et al. 2017), and Estimize (Jame et al., 2016; Da and Huang, 2020), Spekunauten (Philipp and von Nitzsch, 2013), and Forcerank (Da et al., 2021).[3] Findings have been mixed regarding the information content of the various groups. The lack of consensus findings is unsurprising given the various different types of media outlets being used, varying timeframes, and different types of users on the site. For example, Crawford et al. (2017) use SumZero, a private social networking for buy side analysts. In contrast, Giannini et al. (2018) use Twitter which is open to all types of investors.

Our work differs from the existing literature in that rather than look for the information content of a given submission by examining the stock price reaction to the submission, we focus on the retail trader's perspective. Specifically, we form portfolios following a trading strategy than most retail traders on Reddit would be able to implement and evaluate its profitability. This perspective is in the same spirit as Foltice and Langer (2015) and Siganos (2010) who test whether the momentum effect can actually be exploited my individual investors.

3. Data and Empirical Methods

[3] Additionally, Bradley et al. (working paper) have a contemporaneous working paper that also examines WSB posts and find positive returns following certain types of posts. However, they focus only on "Due Diligence" posts from 2018-2020.

Our data spans from the inception of the WSB subreddit in 2012 through the first quarter of 2021. Using textual analysis from WSB submissions, we identify the ticker and whether the submission indicates a recommendation to buy or sell. We proceed with a restrictive set of screens as there is considerable noise in these submissions which are not intended to be analyst recommendations. To identify buy and sell submissions, we use key word searches that include common vernacular for these threads to identify bullish or bearish recommendations. Specifically, for buy recommendations we flag submissions with the following words: buy, bought, moon, hold, call, bull, like, moon, and yolo. For sell recommendations, we flag submissions with the following words: sell, bear, liquidate, sold, put. In order to ensure data integrity, we do not include an analysis of comments or "upvotes" as these occur over time and we drop submissions with conflicting buy and sell signals. This procedure began with a pull of 1,963,471 submissions that contain either a ticker or a buy or sell keyword. Of those submissions, 474,787 contained a buy signal and no sell signal (i.e. no conflict) and 73,776 contained a sell signal with no buy signal. Many of these submissions include false ticker identifiers, for example, "YES" or "BTD" may be identified as tickers. We then merge this dataset with CRSP to weed out false tickers and merge in stock price data. After this procedure, we are left with 221,255 recommendations, 192,550 of which are buy recommendations and 28,708 of which are sell recommendations.

In the appendix, we provide examples of the content of the submissions. The sample submissions show various ways of identifying buy and sell signals. As noted in the table, some are simple submissions with nothing more than a ticker and a direction. Others include technical reasoning such as MACD crossovers or low trading volumes allowing for more price impact. We then merge this data with CRSP and Compustat for stock information and accounting variables,

respectively. Table 1 describes the results from this WSB data scrape and Table 2 presents the accounting variable descriptive statistics.

[Insert Table 1 about here]

Panel A of Table 1 presents the number of submissions with buy or sell signals by year. We also include the number of unique posters by year. Unsurprisingly, the number of submissions increases dramatically over time. The number of unique posters increased from 32 in 2012 to 77,885 in 2021. The GameStop short squeeze began in late 2020 and as news outlets continued to publicize WSB, the subreddit following and posting grew exponentially. The first quarter of 2021 has almost four times as many submissions as all of 2020 and about sixteen times more submissions than all of 2019. Because of this rapid increase, we break out our key analyses by full sample, pre-2021, and post-2021. Panel B presents the most frequent tickers suggested for the full sample and split out by pre-2021 and post-2021. GameStop represents 25.41% of all submissions with 56,233 mentions, most of which occur in 2021. Although GameStop submissions makes up a quarter of the total number of submissions, our empirical strategy ensures our sample is not heavily influenced by any one security. Prior to 2021, the most popular tickers include an S&P500 ETF, Tesla, and Advanced Micro Devices (ADM). Tesla and ADM are unsurprising as they had been popular companies prior to the meme stock explosion. Tesla and ADM both notably had significant exposure to Bitcoin on their balance sheets, making them attractive stocks for retail investors seeking volatility and high potential expected returns.

To form portfolios, we separate stocks by day into long and short. If a stock has been suggested as a buy and a sell in the same day, we take the net effect. For example, if GameStop is suggested 1,000 times to be bought and 100 times to be sold in a given day, we put one equal

weighted share of GameStop in the long portfolio on that day.[4] This method ensures that the portfolio is not overweight in any one stock. If the stock suggestion is made in day t before trading close of 4pm eastern, we assume the security is bought on day t. If the security is suggestion is made after 4pm eastern, we assume the security is bought the following day. This is to ensure there is no peek ahead bias in the data.

We then hold (short) the stock for either one day, one week, one month, or one year before selling (covering). The portfolio is rebalanced daily as new submissions come in daily. For example, for the one day horizon, every day whatever stocks are suggested are bought and they are sold the next day. For the monthly horizon, the investor would buy following a recommendation on day t and hold that security until day t+30. On day t+1, they would buy whatever stocks were suggested on that day and sell them on day t+31, and so on.

To evaluate performance, we use the Fama and French five factor model (Fama and French 1993, 2015) that contains excess market return MKT (R_m - R_f) which is the market return in excess of one month T-bill rate; SMB which is the average return of the nine small stock portfolios minus that of the nine big stock portfolios; HML that longs the two value portfolios and shorts the two growth portfolios; CMA that is the average return on the two conservative investment portfolios minus those on the two aggressive investment portfolios and RMW that buys the two robust operating profitability portfolios and sells the two weak operating profitability portfolios. We also include a momentum factor, denoted MOM. The factor is calculated using six value-weighted portfolios formed on size and prior (t-12, t-12) monthly returns. We take the average return on the two high prior return portfolios minus that of the two low prior return portfolios. We connect the

[4] Later we use method that gives more weight to heavily suggested stocks and results are similar.

daily excess portfolio returns to these factors and run the time-series regression of each portfolio return on the returns of five factors in this specification:

$$R^{e}_{w,t} = \alpha_i + \beta_w R_{MKT,t} + \beta_w R_{SMB,t} + \beta_w R_{HML,t} + \beta_w R_{CMA,t} + \beta_w R_{RMW,t} + \beta_w R_{MOM,t} + \varepsilon_{i,t} \quad (1)$$

where β_w measures the factor loadings of our portfolios constructed based on WSB recommendations on the five factors, or w portfolios. We focus on α_i that measures the abnormal daily returns the WSB portfolios earn after being explained by common risk factors in the return space. Importantly, our findings are robust to the use of simple excess returns. Because we are focused on the profitability of a trader's performance, we adjust returns for the bid-ask spread by taking the bid-ask spread, dividing by two, and subtracting from the daily return.[5] Returns are total returns and include dividends. Standard errors in parentheses are heteroskedasticity and autocovariance consistent (HAC).

Table 2 displays how many unique firms are in the long and short portfolios each year. Although some firms like GameStop and others are Reddit favorites, there exists a wide breadth of firms that are suggested on the thread. In the first quarter of 2021 alone, there are 2,319 unique firms in the long portfolio and 527 in the short portfolio.

[Insert Table 2 about here]

Panel B presents the characteristics of the typical stock suggested by the subreddit and compares it to the S&P500. The typical firm suggested as a buy in WSB is more than three times smaller than the typical firm in the S&P500. This finding speaks to the risk profile of the investment strategy. Generally, Redditors are seeking high risk, high reward opportunities.

[5] Results are not sensitive to the choice to include or exclude the bid-ask spread adjustment. We implicitly assume trading commissions are $0, consistent with the current environment.

Additionally, the average market to book ratio is 24.14 for buy recommendations, 2.71 for sell recommendations, and 3.88 for the S&P500. Redditors generally appear to prefer growth firms such as Tesla over value firms. Lastly, consistent with the group seeking out short squeeze opportunities, the typical short interest as a percent of float for buy recommendations is 9% compared to just 3% for the S&P500. For their short recommendations, the typical firm is larger than the long recommendations but still about half the size as the average S&P500 firm. Interestingly, short suggestions tend to be value firms with market to book ratios below that of the S&P500. Short interest is 10% for these firms, suggesting they are popular shorts. Taken together, the WSB community focuses on small growth firms with high short interest for buys and somewhat larger value firms with high short interest for sells.

We are also interested in how these portfolios perform bifurcated by market sentiment. To proxy for market sentiment, we use the put-call ratio. This ratio is obtained from the Chicago Mercantile Exchange and is the daily number of traded put options relative to the number of traded call options. When the ratio is above 1, it suggests bearish sentiments as options traders are favoring puts over calls. We rerun the portfolio regressions to test whether alpha is different from 0 when sentiment is bullish or bearish.

Furthermore, we examine the abnormal trading volumes surrounding the posting date. We use abnormal stock turnover similar to Llorente et al. (2002) to standardize the abnormal trading volumes. Specifically, turnover is log-transformed daily trading volume scaled by total shares outstanding. To calculate abnormal turnover, we calculate average of daily log turnover over the past year. Then we subtract the average turnover from the days turnover to obtain the abnormal turnover. The following equation displays the calculation:

$$Abnormal\ Turnover_t = Log\left(\frac{Volume}{Shares\ Outstanding}\right)_t - Average\ Log\left(\frac{Volume}{Shares\ Outstanding}\right)_{t-6,t-252} \quad (2)$$

We calculate abnormal turnover for each day within 6 days before and after the submission. Any abnormal volume greater than 0 suggests higher than typical trading volumes for the day relative to the previous year. The average abnormal turnover by day is calculated and plotted based on buy and sell groups in figure 1. We include 95% confidence interval bands to show whether these abnormal turnover values are statistically different from zero.

Finally, we are interested in differential ability to predict stock performance by various WSB users. We employ an event study strategy to investigate the cumulative abnormal returns (CAR) for the top 40 WSB users ranked by the total number of daily submissions.[6] We calculate the CAR in the window of [t+1,t+2] following the submission. We use the Fama French 5 factors plus a momentum factor in running the Event Study, which first obtains abnormal returns in this specification:

$$AR_{W,t}=R_{W,t} - (\alpha_i+\beta_w R_{MKT,t} + \beta_w R_{SMB,t}+\beta_w R_{HML,t}+\beta_w R_{CMA,t} + \beta_w R_{RMW,t} + \beta_w R_{MOM,t}) \quad (3)$$

next, it calculates CAR as follows:

$$CAR_{W,t} = \sum_{t=1}^{2} AR_{W,t} \quad (4)$$

4. Results

We begin by examining the abnormal turnover around WSB stock recommendations. Abnormal turnover measures trading volume relative to the stocks previous year's moving average volume. Figure 1 displays the results. A similar pattern emerges whether the stock is suggested as a buy or sell. In each case, abnormal turnover peaks on the day of the stock recommendation.

[6] Results are similar using the top 50 posters.

However, there also appears to be a run up in the days leading to the announcement, suggesting stocks that are recommended are "hot" leading up the WSB crowd's involvement. Abnormal turnover around buy signals are slightly greater than sell signals. That is, investors following WSB are more likely to trade following a buy recommendation than a sell. This is perhaps explainable by the ease of which one can enter a long position compared to a short one.

Confidence interval bands at the 95% level are included to visualize the statistical significance of these values. For all days in the [-6,+6] trading day window, abnormal turnover is positive and statistically significant well beyond the 5% level. Although day t+1 has lower positive turnover than day t, on both days there is significant trading activity around these stocks. Overall, this evidence suggests WSB community submissions may incite trading activity on the equities.[7] The more critical question, however, is whether these suggestions lead simply to trading activity or persistent profitability. We next examine returns to portfolios formed using these recommendations.

Table 3 presents the results of the portfolio analysis for the full sample of data. Each panel displays daily alphas for the long portfolio, the short portfolio, and the long minus short portfolio. Columns 1 to 3 are based on each stock being held (short) for one trading day and then sold (covered). Columns 4 to 6 are based on holding each stock for one week, columns 7 to 9 are based on holding the stock for one month, and columns 10-12 are based on holding each stock for one year.

[Insert Table 3 about here]

[7] In untabulated results we split this analysis out by pre-2021 and post-2021. Both subsamples provide similar results with the weakest result being around sell recommendations in the post-2021 subsample.

The primary coefficient of interest is alpha. Across all holding periods, the long minus short portfolio fails to produce alpha that is indistinguishable from zero. For holding periods of one day to one week, the alpha coefficient is positive but insignificant. At longer horizons, it is negative and insignificant. The only statistically significant alpha is the short leg of the one week portfolio which is significant at the 10% level. In untabulated analysis we find similar results for if the stock is held for two days or three days. Interestingly, the long portfolio across every holding period is negative, directionally inconsistent with achieving good performance.

The factor loadings provide useful information regarding the types of stocks in the long and short portfolios. Across each time horizon, the market factor loads greater than one and significantly on both the long and the short portfolios. This suggests that Redditors target high market beta stocks both to buy and to sell. These cancel out on the long short and lead to a statistically insignificant factor loading. Additionally, HML always loads negatively and significantly in the long portfolio and the short portfolio. This is consistent with Redditors targeting growth stocks over value stocks for buy and sell recommendations. CMA loads negatively across most portfolios as well, suggesting Redditors target firms that invest heavily more so than those that invest conservatively. MOM tends to be positive and significant in the long portfolios as well. This suggests Redditors are more likely to target past winners. For the longer horizons, there are some positive loadings on RMW and negative loadings on SMB. These findings are somewhat surprising because they suggest the portfolio contains more profitable and larger stocks.

We recognize there is a significant uptick in WSB activity in 2021. There are counteracting forces regarding whether WSB submissions would be more or useful in a trading strategy post-2021. On the positive side, there is more investor attention focused on this thread, so submissions

may be visible by more parties willing to push prices in the direction of the submission. On the negative side, many new users join the thread and perhaps new users are not as informed as the original users that made WSB famous in the first place.

Table 4 presents portfolio results split out by pre-2021 and post-2021. Panel A presents the pre-2021 results and Panel B presents results for only the first quarter of 2021 when the platform increased most significantly in popularity. The pre-2021 results are very similar to the full sample results regarding alphas and many of the factor loadings. This alleviates the concern that the results are driven only by the recent GameStop and other meme stock trading activities. Interestingly, in the post-2021 sample, none of the alphas are statistically different from zero. Though the one day long minus short portfolio is positive, the one week holding period and one month holding period long minus short alphas are negative, driven by positive average alpha around sell recommendations.

[Insert Table 4 about here]

Given we are constrained to one quarter of data in the post-2021 era, we are careful to draw conclusions from a small sample. However, differences in factor loadings can be instructive as the post-2021 era includes a different set of WSB users. The most notable difference between the post-2021 factor loadings and the pre-2021 factor loadings is the coefficient on the momentum and investment factors. For both the full sample and the pre-2021 samples, the loading on momentum is zero on the one day portfolio and positive and marginally statistically significant on the long portfolios in the one week and one month holding periods. However, in the post-2021 sample, the MOM factor in the long portfolio loads positive and significant in every time horizon. The

magnitude of the coefficients are significantly larger as well. This result is consistent with intuition that much of the meme stock trading is driven by momentum. However, the MOM factor does not load in the long short portfolio except for the one month holding period because Redditors also tend to recommend selling positive momentum stocks. The difference in the investment factor loading is less obvious economically. While in the pre-2021 period the loading suggest the firms in the portfolio are firms that invest aggressively, the post-2021 loading suggest the firms invest more conservatively.

Overall, we interpret these findings as evidence that a trading strategy following WSB recommendations does not produce alpha. In no cases were the buy recommendations as a group fruitful and in very few cases were the sell recommendations useful. As the viewership and contribution to this public thread has grown, alpha is equally elusive.

We next examine whether the returns to a portfolio following the WSB thread differs by market sentiment. We calculate the daily put-call ratio and group days where sentiment is bearish (put-call >1) and bullish (put-call <1). We focus on the daily holding period horizon as sentiment shifts day to day and many Reddit traders are short term oriented. The results are presented in Table 5.

[Insert Table 5 about here]

In both subgroups, alpha is insignificant. Although the long short alpha continues to be indistinguishable from zero, there are a few notable differences between the two subsets of results. First, alpha is directionally positive on bullish days and negative on bearish days. Interestingly, on the bullish days, alpha on the short leg of the portfolio is marginally significant at the 10% level. Although the results are weak, this would imply Reddit posters are able to identify opportunistic

times to sell when the market is bullish. Overall, these results mirror the primary finding of this study that the strategy following the WSB strategy fails to produce alpha.

The focus of our paper is to address whether a simple trading strategy following WSB submissions is a profitable endeavor. However, undoubtedly, there are an infinite number of ways to disaggregate the data in search of other strategies. One such strategy may be to take recommendations only from well-known or frequent posters. To this end, we indentify the top 40 most frequent posters and examine the average long minus short one-day CAR following their submission. If new and infrequent posters are producing uninformed stock opinions, perhaps the top 40 posters would eliminate some noise. The results of this exercise are presented in Table 6.

[Insert Table 6 about here]

There exists considerable heterogeneity across top posters, and the symmetry around 0 is striking. The top 40 posters make up 1.6% of total submissions, a niche subsample. Although the average long minus short CAR is 25 basis points, 21 of the posters have negative average CARs and 19 have positive average CARs. This evidence is generally consistent with our baseline portfolio results that alpha is elusive in following WSB submissions. A strategy following only frequent posters does not improve the ability to predict stock prices in the short term. However, it is notable that some posters individually were quite successful in their stock picking.

While the mean value of the long minus short CAR is 25 basis points, additional statistics regarding the distribution of performance is useful. The median is -38 basis points, reflecting that more top posters have negative CARs than positive ones. The 95 confidence interval around the mean of 25 basis points is -1.61% and 2.11%, indicating the mean of 25 basis points is statistically

indistinguishable from zero. Overall, these results suggest that the most frequent posters are no more likely to generate alpha on average.

5. Robustness

We next conduct several robustness tests to ensure that our primary results are not driven by certain design choices. Specifically, we address three concerns. First, in our baseline design, we do not overweight stocks that are recommended more times in given day. For example, if GameStop was recommended 100 times on day t and Apple was recommended only 5 times, they are equally weighted in the portfolio on that day. This choice reflects the simple choice of a trader following the thread to buy each stock she sees. However, arguably a trader could overweight stocks that are recommended more frequently.

To address this comment, we rerun our daily horizon portfolio tests but weight holdings by the number of submissions. In the previous example, GameStop would receive 20 times greater weight than Apple on the trading day. Results of these regressions is presented in Table 7 in the first three columns. Alpha continues to be insignificantly different from zero. Other patterns are also similar to the baseline tests in that alpha for the long portfolio is negative and alpha for the short portfolio is negative as well, although the short portfolio alpha is significant.

[Insert Table 7 about here]

Next, in our baseline portfolio formation, we do not distinguish between submissions based on any proxy for submission quality. A submission that simply says “Buy Apple” would receive the same weight as one that contains a long report on fundamental or technical reasons to buy Apple. Bradley et al. (working paper) focus on a subsample of the highest quality WSB submissions and find that these recommendations do have predictive power. To alleviate the concern that a trader following the WSB thread would focus on submissions of higher quality, we

weight submissions by word count, where we add the title and body of the submission together. Word count is an imperfect proxy for how much information a poster provides when recommending a stock. In this weighting scheme, a recommendation with more words recommending Apple would receive a higher weight in a portfolio than one with less words recommending AMC Theatres. Results from these tests are in columns 4 to 6 of Table 7. Consistent with our primary results, alpha on the long short portfolio is indistinguishable from zero. Alpha on the long portfolio is negative and statistically significant, indicating underperformance of this portfolio.

Finally, the number of WSB submissions increased significantly over the sample period. A potential concern is that early in the sample the portfolios have much fewer stocks than those in the later periods. For days that are in the sample, the buy and sell portfolios have an average of 1.65 and 1.38 stocks in long and short portfolios per day, respectively, for the daily horizon portfolio in 2012.[8] Portfolio size rises significantly over time to include 194.12 stocks (long) and 14.57 stocks (short) per day in 2021. The number of stocks in the portfolio is larger for longer holding periods. The underlying assumption of our baseline tests is that a trader following Reddit would have the same amount of capital in 2012 as they would in 2021 and they would allocate the capital amongst the stocks evenly depending on how many recommendations exist at a given time. To alleviate the concern that the thinnest years of the sample are driving the result, we rerun the baseline tests dropping the first two years of observations (2012 and 2013). Results are presented in Table 7, columns 6 to 9. Again, results are very similar to the baseline regressions. Across all

[8] There are several days, especially in early years, where there are no recommendations made. Those days are not included in the sample.

robustness specifications, consistent with our main findings, alpha continues to be indistinguishable from zero.[9]

6. Conclusion

We investigate whether a simple and intuitive trading strategy following WSB submissions can produce alpha. Rather than develop a more sophisticated method for following WSB, our goal is to mimic the trading strategy a typical retail investor may follow to see how they would perform. Overall, we document that while WSB do induce increased trading activity, there is no evidence of outperformance on a risk adjusted basis.

Our findings contribute to a timely discussion on retail investors in financial markets that are more available than ever. Additionally, the results serve as useful information to the droves of retail investors searching the internet for trading advice. Productive future work will disaggregate the WSB subreddit data and identify pockets of successes and failures as we learn more about fruitful sources of information.

[9] In untabulated analysis, we also run portfolio regressions in the post-2021 period with GameStop removed. Results are similar.

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References

Antweiler, W., & Frank, M. Z. (2004). Is all that talk just noise? The information content of internet stock message boards. *The Journal of finance*, *59*(3), 1259-1294.

Baker, M., & Wurgler, J. (2007). Investor sentiment in the stock market. Journal of economic perspectives, 21(2), 129-152.

Bandopadhyaya, A., & Jones, A. L. (2006). Measuring investor sentiment in equity markets. Journal of Asset Management, 7(3), 208-215.

Bandopadhyaya, A., & Jones, A. L. (2008). Measures of investor sentiment: A comparative analysis put-call ratio vs. volatility index. Journal of Business & Economics Research (JBER), 6(8).

Bartov, E., Faurel, L., & Mohanram, P. S. (2018). Can Twitter help predict firm-level earnings and stock returns?. The Accounting Review, 93(3), 25-57.

Boehmer, E., Jones, C. M., Zhang, X., & Zhang, X. (2021). Tracking retail investor activity. The Journal of Finance, 76(5), 2249-2305.

Bradley, Daniel and Hanousek Jr., Jan and Jame, Russell and Xiao, Zicheng, Place Your Bets? The Market Consequences of Investment Advice on Reddit's Wallstreetbets (March 15, 2021). Available at SSRN: https://ssrn.com/abstract=3806065 or http://dx.doi.org/10.2139/ssrn.3806065

Chen, H., De, P., Hu, Y. J., & Hwang, B. H. (2014). Wisdom of crowds: The value of stock opinions transmitted through social media. The Review of Financial Studies, 27(5), 1367-1403.

Da, Z., & Huang, X. (2020). Harnessing the wisdom of crowds. Management Science, 66(5), 1847-1867.

Da, Z., Huang, X., & Jin, L. J. (2021). Extrapolative beliefs in the cross-section: What can we learn from the crowds?. Journal of Financial Economics, 140(1), 175-196.

Das, S. R., & Chen, M. Y. (2007). Yahoo! for Amazon: Sentiment extraction from small talk on the web. Management science, 53(9), 1375-1388.

Hirschey, M., Richardson, V. J., & Scholz, S. (2000). Stock-Price Effects of Internet Buy-Sell Recommendations: The Motley Fool Case. Financial Review, 35(2), 147-174.

Fama, E. F., & French, K. R. (2015). A five-factor asset pricing model. Journal of financial economics, 116(1), 1-22.

Foltice, Bryan, and Thomas Langer. "Profitable momentum trading strategies for individual investors." Financial Markets and Portfolio Management 29, no. 2 (2015): 85-113.

Fong, K. Y., Gallagher, D. R., & Lee, A. D. (2014). Individual investors and broker types. Journal of Financial and Quantitative Analysis, 49(2), 431-451.

Garcia, J., 2021. Analyst herding and firm-level investor sentiment. Financial Markets and Portfolio Management, pp.1-34.

Klein, M. C. (2021). Americans Are Sitting On Lots of Spare Cash. It May Not Boost Growth Much. https://www.barrons.com/articles/americans-are-sitting-on-a-lot-of-spare-cash-it-may-not-boost-growth-as-much-as-youd-think-51614366901.

Kumar, A., & Lee, C. M. (2006). Retail investor sentiment and return comovements. The Journal of Finance, 61(5), 2451-2486.

Llorente, G., Michaely, R., Saar, G., & Wang, J. (2002). Dynamic volume-return relation of individual stocks. The Review of financial studies, 15(4), 1005-1047.

Stambaugh, R. F., Yu, J., & Yuan, Y. (2012). The short of it: Investor sentiment and anomalies. Journal of Financial Economics, 104(2), 288-302.

Stephan, Philipp, and Rüdiger von Nitzsch. "Do individual investors' stock recommendations in online communities contain investment value?." Financial Markets and Portfolio Management 27, no. 2 (2013): 149-186.

Siganos, Antonios. "Can small investors exploit the momentum effect?." Financial markets and portfolio management 24, no. 2 (2010): 171-192.

Tumarkin, R., & Whitelaw, R. F. (2001). News or noise? Internet postings and stock prices. Financial Analysts Journal, 57(3), 41-51.

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