POLITECNICO MILANO 1863

SCUOLA DI INGEGNERIA INDUSTRIALE E DELL'INFORMAZIONE

THE MEME STOCK PHENOMENON OF 2021

TESI DI LAUREA MAGISTRALE IN MANAGEMENT ENGINEERING-INGEGNERIA GESTIONALE

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Academic Year: 2020-21

Abstract

Early 2021 saw the birth of meme stocks, an unprecedented phenomenon in the stock markets where a series of stocks of seemingly failing companies with particularly high short interest, the most relevant of which GameStop, experienced price surges unpredicted by any kind of fundamental analysis due to coordinated retail trading activity. As such, this report aims to give a holistic view at the phenomenon.

To achieve this, we start by looking into short sales and the relevant regulation overseeing them, in particular the locate and close-out requirements established the U.S. Securities and Exchange Commission.

Secondly, we explore both how these requirements can be theoretically exploited in stocks with high short interest to turn a profit by potentially triggering gamma and short squeeze events and how one might define possible targets for these strategies. To aid us in this we examine the 2008 Volkswagen short squeeze, the most relevant past example of a short squeeze, as well as the more recent case of GameStop in order to understand their feasibility and the actual reasons behind these episodes.

Lastly, we conclude by going through some of the factors that have allowed for these anomalies to take place in the first place. Specifically the rise of discount brokers and their business model, investment forums and the behavioral phenomena taking place in them, and the COVID pandemic and its implications on retail trading.

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Introduction

“Meme stocks” are a new internet phenomenon born in the late 2020s that has taken financial markets by surprise, with considerable and enduring consequences. They are like anything else before, and in order to understand them one must first look into its roots.

A “meme” is an integral part of internet culture. Usually an idea, behavior or style with comedic purposes which spreads through the internet via social media platforms resulting in trends or crazes that tend to grow at extremely high pace, reaching a high number of people in very little time. Originally born as simple images with catchphrases, they have since evolved to include more complex structures such as gifs, videos, challenges or, in this particular case, stocks.

As such then, meme stocks are characterized by high interest from social media which in turn tends to draw retail investors in. This increased attention results in elevated trading volumes which themselves lead to sharp increases in prices in short periods of time and absurd levels of volatility. They are unlike value or growth stocks in that price increase is rarely backed by company fundamentals and is just the result of a new influx of traders fueled by conversation on social media. Thus, affected stocks experience short periods of extreme overvaluation before reversing back (or much closer) to the price predicted by fundamentals once all the “fuzz” is over and investors start cashing out.

The biggest and clearest example of this phenomenon took place at the beginning of 2021 when a group meme stocks, among which probably the most important ones GME, NOK, AMC and BB, experienced surges in prices unpredicted by any kind of fundamental analysis.

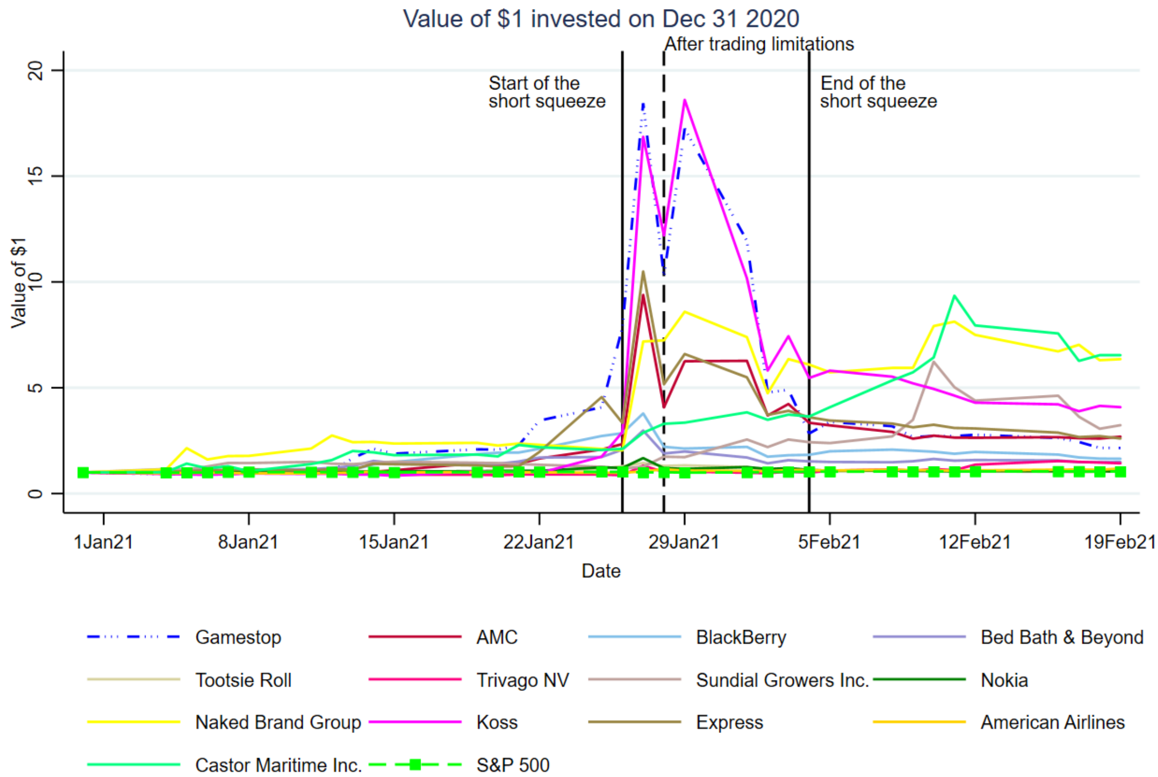

Figure 1: Stock price evolution for GME, NOK, AMC and BB among others

Source: Squeezing Shorts Through Social Media Platforms (2021)

The reason behind it? Successful coordination attempts by specialized online forums, mainly Reddit's r/wallstreetbets, aimed at exerting bullish pressure on stocks targeted by investment funds and with supposedly high short interest in order to trigger a "short squeeze events". Attempts that rapidly broke free from its original internet niche, taking hold of mainstream media. Building up on itself and presumably triggering snowball effect that helped the event reach unprecedented levels of attention that in turn aid in rendering its effects ever so larger and impactful.

Stock	Closing Price 04/01/2021	Peak February Price	Variation
GME	$17.25	$483.00	28.0x
NOK	$3.89	$20.36	5.2x
BB	$6.58	$28.77	4.4x
AMC	$2.01	$20.37	10.1x

Figure 2: GME, NOK, AMC and BB peak turnover

Source: Yahoo Finance

By the time the original wave of short squeezes was over, roughly taking place from January the 26th to February the 4th, targeted meme stocks achieved ridiculous levels of returns when considering the peak price during the squeeze windows. With the most notable example and highest focus of attention being GME which achieved a maximum price of U$D 483 per share, briefly skyrocketing its capitalization to around U$D 38,5 billion. All in all, proving meme stocks to be a profitable yet extremely risky venture.

With this, the considerable effect of a new set market forces was demonstrated. Forces, presumably centered not in the traditional ideas of fundamental analysis and the efficient market hypothesis, but emanating from social media and based on seemingly "irrational" social and psychological behaviors. Forces without which the occurrence of the aforementioned events would not be possible.

Thus, in this report we will try to understand the new phenomenon of meme stock by thoroughly looking at the players involved, the profiting strategies used to benefit from it, the regulation behind it and both the social and structural factors facilitating it. By the end hopefully arriving at a comprehensive understanding of it.

Relevant Regulation Overseeing Short Sales

As anticipated, meme stocks and short squeezes are closely related topics. But before we can venture into the second one, we must first understand the basic ideas behind it. So let us first begin by understanding what a short sale is.

Short Sale

A short sale is the sale of a stock one does not possess, but plans to buy or borrow at the time of delivery. It is called so, because the seller is “short” a certain number of stocks at the time of the transaction. In nature it is a bearish instrument in that speculators can hope to profit from it were the price of the underlying stock to decrease in the future, a strategy only undertaken by experienced traders as it carries substantial risk as the possible losses from a short position are theoretically uncapped. Nevertheless, its most common use is as hedging instrument against the downside risk of a long position in the underlying asset.

In practice, a trader can establish a short position by borrowing shares from a broker (at an interest) and selling them on the market, as one cannot sell shares that do not exist. The position is closed once the trader buys the shares back from the market and returns them to the broker at a loss, were the underlying to increase in value, or at a profit, were the situation to be the contrary. In order to do so, one must be in possession of a margin account, a special kind of brokerage account that allows for this operation which is both available to institutional and retail investors alike, albeit with some special requirements.

Another more sophisticated way to incur into a short position is through the selling or underwriting of a call option. A financial contract that gives the buyer the right, but not the obligation, to buy the underlying stock at a predetermined price (strike price) and time. In order to do so, the seller must either hold the underlying stock or have significance evidence to believe that it will be able to procure or borrow the stock at the time of settlement. Thus, a trader selling a call option can synthetically gain short exposure to the underlying stock, as it profits in the case of a price decrease on the underlying. Although not exclusive to institutional investors, this kind of operation is uncommon for retail investor s they usually lack the knowledge to do so.

Having gone through this then, we can move on to the regulation regarding short sells.

The SEC and Reg SHO

In the United States, the role of overseeing and regulating short sales, among many other different aspects regarding American securities markets, falls to the Securities and Exchange Commission (SEC). The SEC is an independent agency of the United States federal government founded at the height of the Great Depression whose whole mission is to protect investors, maintain fair, orderly, and efficient markets, and facilitate capital formation.

In particular, the specific directive that oversees all short selling is regulation SHO. Born in 2005 it is intended to reduce the number of potential failures to deliver, limit the time in which a broker can permit a failure to deliver to persist and address potentially abusive naked short selling.

Naked short sells are a special kind of short sells in that the seller does not borrow or arrange to borrow the shorted stock in order to deliver it to the buyer in the 3-day settlement window established by the SEC. Although seemingly more obscure in nature, naked short selling does not necessarily comprise an illegal activity or incurs into any violation of the Commission’s directives. In fact, under bona fide market making it can help increase liquidity, especially in thinly traded illiquid stocks, and even improve market information by allowing negative sentiment to be reflected in certain stocks' prices where stock might have a limited float and a large number of shares in friendly hands. What is illegal however, is any use of naked short selling, or any short selling for that matter, with the explicit intent of driving down the price of a security, as this contributes an act of market manipulation. Thus the SEC has set up a set of rules in order to prevent any kind of abuse, the most relevant of which we discuss next.

Rule 203 or “Locate Requirement” establishes that before effecting a short sale, a broker must hold reasonable grounds to believe that the underlying security can be borrowed to be delivered at the time settlement. Exempt from this rule are bona fide market makers providing liquidity to markets.

Rule 204 or “Close-out Requirement” establishes that brokers that are participants of a registered clearing agency must take action to close out failure to deliver positions by purchasing or borrowing securities of like kind and quantity. For securities with large and persistent failures to deliver, participants of a registered clearing agency must immediately purchase shares in order to close out the position. This are the so-called threshold securities which are equity securities that have an aggregate fail to deliver position of five or more consecutive settlement days at a registered clearing agency, total 10.000 shares or more and equal at least 0,5% the issuer's total shares outstanding.

In consequence, a security being part of a threshold list can be considered a sign of naked short selling, as the broker dealer is consistently unable or unwilling to procure the underlying asset for delivery, indicating a possible breach in rule 203 and 204. It must be noted however, that consistent failure to deliver can also be caused by benign reasons such as human or technical error. Nevertheless, it remains an important clue when understanding whether a certain stock is being subject to naked shorting or not.

Circumventing Strategies

Regardless of regulation and penalties, mischievous broker dealers might be tempted to breach the rules set by the Commission, as opportunities regarding threshold securities might prove to be profitable ventures. Opportunities that arise from the fact that large and persistent fails to deliver in the security might give rise to pricing differential in its available options, putting the put-call equation into temporary imbalance.

The formula for Put/Call Parity is: $C(S,t) - P(S,t) = S(t) - K*e^{-r(T-t)}$

Where,
- $S(t)$ = Current stock price
- $P(S,t)$ = Put price given stock price at time t
- $C(S,t)$ = Call price given stock price at time t
- K = Strike price of Put and Call
- r = Risk free rate
- t = Current date
- T = Expiration date of Put and Call

Figure 3: Put-Call parity equation

Source: SEC

As a security enters into a threshold list, it might progressively become harder to borrow, meaning borrowing rates surge proportionately. In consequence, the actual shares trade at higher prices in order to reflect the increased risk that shares cannot be borrowed and will necessarily need to be purchased in order to comply with Reg SHO close out requirement. In contrast, the synthetic long position, achieved by purchasing at the money (ATM) calls and selling an equivalent number of

ATM puts with the same settlement date and strike price, is not subject to this and thus does not reflect an increased premium. All in all, leading to a temporary imbalance in the equation.

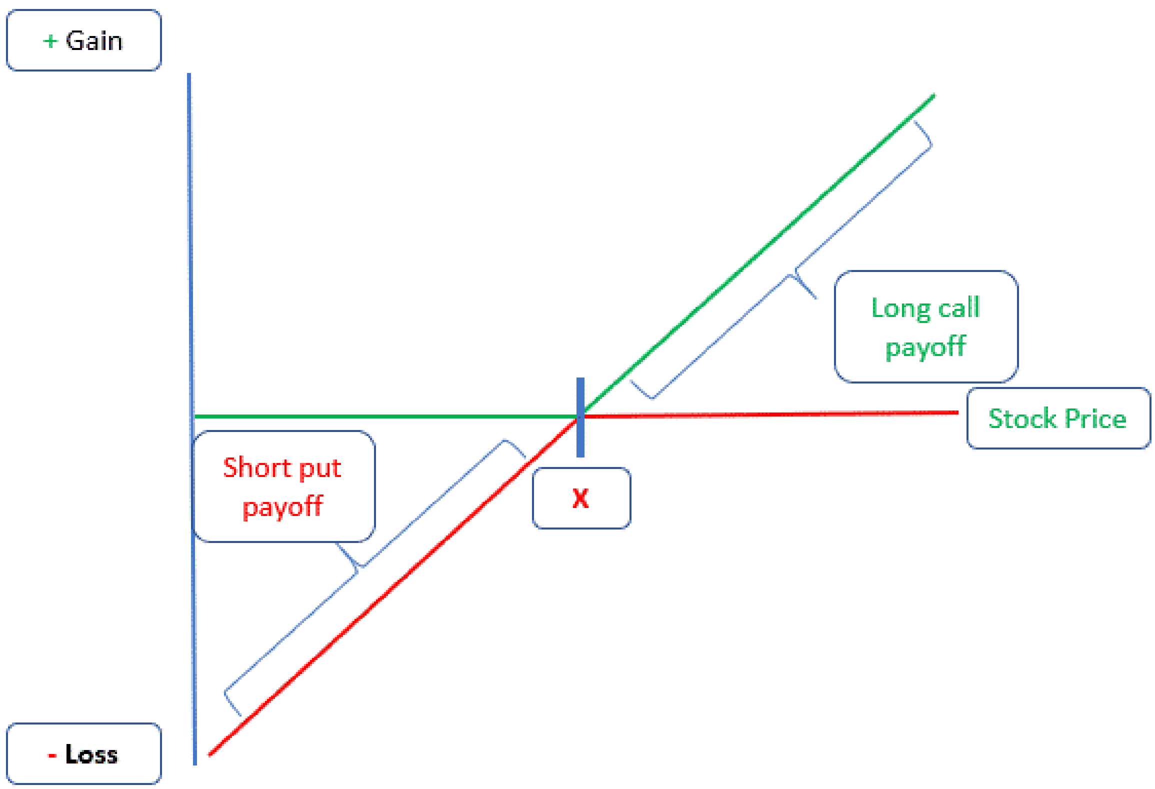

Figure 4: Synthetic long position

Source: SEC

Where such differences between the value of the actual share and its synthetic option exist, there is a potential profit to be made. However, such opportunities are extremely rare and are only accessible to institutional traders who benefit from lower fees and commissions which might allow them to turn a net profit.

One strategy that could be put into place to take advantage of the potential profit opportunities created by a stock becoming hard to borrow is to initiate a Reversal. A reversal is the complete hedging of a short position by coupling it with an equivalent synthetic long position, which under normal circumstances results in a perfectly hedged profitless position. But which in a hard to borrow context allows arbitrageurs to turn a riskless profit. To do so however, fees to borrow and commissions must be sufficiently low so as not to eat up on profit. Thus this strategy is most often initiated by broker dealers who claim to be exempted from Reg SHO locate requirement as bona fide market making activity, which allows them to do without possible borrowing fees.

Regardless of exemptions to the locate requirement, all market participants are subject to the close out requirement, meaning all short positions must be eventually closed. Nevertheless, short sellers might be tempted to fail to deliver the actual share at the time of settlement, as they might be reluctant to pay the borrowing fee on the shares to make delivery, or unwind the position by purchasing the shares in the market. Due to the fact that the security being hard to borrow leads to increased borrowing fees and asset price which might result in losses.

To achieve this, meaning consistently fail to deliver a share at the time of settlement to avoid paying the higher fees or assets price, an ill-behaved trader might attempt to circumvent the close out requirement by engaging in a series of buy-writes. These contemplate the underwriting of deep in the money calls and purchase of shares against the call sale. By doing so, the trader appears to have purchased shares to meet the clearing agency’s close-out requirement for the fail to deliver that resulted from the short sale. In practice, however, there is no intention of delivering the shares, and the transaction is instead solely designed to give the appearance of delivering the share while re-establishing or extending a fail position.

Such transactions are usually, but not always, prearranged trades between colluding counterparties. Such that the price is determined in a way that the short seller pays a small premium to the other market-maker for the trade, resulting in no economic benefit to him other than giving the appearance of meeting delivery obligations. In this way, the short seller can continue to execute buy-write reset transactions whenever necessary, giving up some of the profits in the form of premiums, and by the time of expiration of its original reversal it has maintained its short position without paying the higher cost to borrow or purchase shares to make delivery on the short sale.

Profiting Strategies

Having understood the relevant regulations and directives overseeing short sells, and thus short calls, we can then move on to the profiting strategies for meme stocks enacted by gambling traders.

The strategy at hand is twofold, consisting in the (hopeful) triggering of both a gamma and a short squeeze event. Events which are themselves reliant firstly on the reluctance of institutional option underwriters to comply with the "Locate Requirement", and secondly and most importantly on their compliance with the "Close-out Requirement" as established by the SEC. Thus the strategy focusses on companies thought to be target of substantial naked short selling, meaning with a high availability of uncovered calls for purchase ideally in violation of the "Locate Requirement". Were this not to be true, the strategy could be put into place regardless but with no predicted benefit whatsoever to the trader, since it is solely reliant on these two prerequisites, without which it would be pointless.

Gamma Squeeze

The gamma squeeze is the initial part or result of the strategy, as it takes place on the days before the settlement of the short sale. To recapitulate, the underwriting of naked call options creates a short position for the seller, in which the underwriter's profit increases with the price decrease of the underlying asset, meaning capped profits but theoretically unlimited losses. To prevent this, sellers have the option of hedging their position by purchasing the underlying asset at a known price at any time before the call settlement date, converting their naked calls into covered ones.

This type of hedging is called "Delta Hedging" and reduces the risk of price movements in the underlying asset by offsetting the short position (underwriting of an uncovered call) with a long position (underlying asset purchase). The hedge ratio or "delta" represents the change in the value of an option in relation to the movement in the market price of the underlying asset, at the money options tend to have higher deltas as a small change in the price of the underlying can have significant effects on option demand, whereas deep in or out of the money options have smaller deltas as option price is insensible to asset price. This change in Delta is called Gamma, and it's a measure of the volatility of the option's price.

Thus an underwriter originally selling out of the money calls must buy additional stock of the underlying asset as the price of the asset increase in order to hedge its position, since as the price of the underlying gets closer to the strike price the delta also increases and so does his exposure to risk. If the position to hedge is sufficiently big, the buying action of the hedge exerts upward pressure on the price of the underlying, which can develop into a positive feedback loop, as call under writers react to the rising price by buying the underlying to avoid exposure to the risk that its price may rise further and so on. Every buying transaction by a short-seller sends the price higher, forcing another short-seller to buy. Leading to abrupt asset price increases in short period of times which in turn triggers further short-dated call option buying, exacerbating the price increase even more.

Figure 5:Gamma squeeze spiral

Short Squeeze

While a gamma squeeze can be seen as the byproduct of the strategy, it is the short squeeze that is the focus of it. A short squeeze is a rapid increase in the price of an asset owing primarily to an excess of short selling rather than underlying fundamentals. It takes place when there is a lack of supply and an excess of demand for the stock due to short sellers having to buy stocks to cover their short positions and contrarian traders holding on to their long positions. Because short sellers exit their positions with purchase orders, their simultaneous exit pushes prices even higher. This continued rapid surge in price also attracts buyers to the security. The combination of new buyers and panicked short-sellers can create a positive feedback loop that can skyrocket asset prices to unprecedented levels. At least for a short period of time before the stock reverts back to fundamental value that is.

As such, a short squeeze is a clear case of contrarian investing. Where wagering traders bet against the prevailing market belief that the price of a specific stock will continue to fall. This bet comes in the form of stock and call options purchases, with this, contrarian traders aim to achieve two things. First, by buying and holding a given stock they aim to create a mismatch between supply and demand, exerting positive pressure on its price. As well as negate the offsetting effects of "smart money" which may know the stock is prices ridiculously high but will be sent to sidelines as it does not own the share to sell and all the easily shortable shares will have been already used. Secondly, through call option purchases they aim to further increase this effect by the means of a gamma squeeze, forcing short sellers to buy stock in order to hedge, as originally out of the money call options become at the money due to positive price pressures.

By doing so, these traders hope that by the time of settlement of their calls they will have become deep in the money, forcing underwriters to purchase the underlying stock in order to close out their position in compliance with reg SHO Close-out requirement. Action which, in a context were the stock has a high short interest coupled with the fact that it has become hard to borrow due to a shock in supply and mismatch with demand, causes the price of the underlying to skyrocket for a brief amount of time. Allowing cunning traders to potentially turn a ridiculous amount of profit in a short period, at a great risk however, since the surge in price is generally short lived.

Bullish pressure mechanism

There is no squeeze however if the price of an asset does not rise enough so as to turn out-of-the-money calls into in-the-money calls. To that extent, traders execute different strategies and tactics, but in order to understand them we must first take a short look at how asset price is determined in the stock market.

In its simplest form, the stock market works like any other economic market, meaning prices are driven by supply and demand, when demand exceeds supply, prices rise, and when the opposite happens, they fall. This mechanism ensures that demand matches supply through the price level, if there are any changes in the supply or demand curves, the price changes accordingly to keep the market in equilibrium and guarantee clearing.

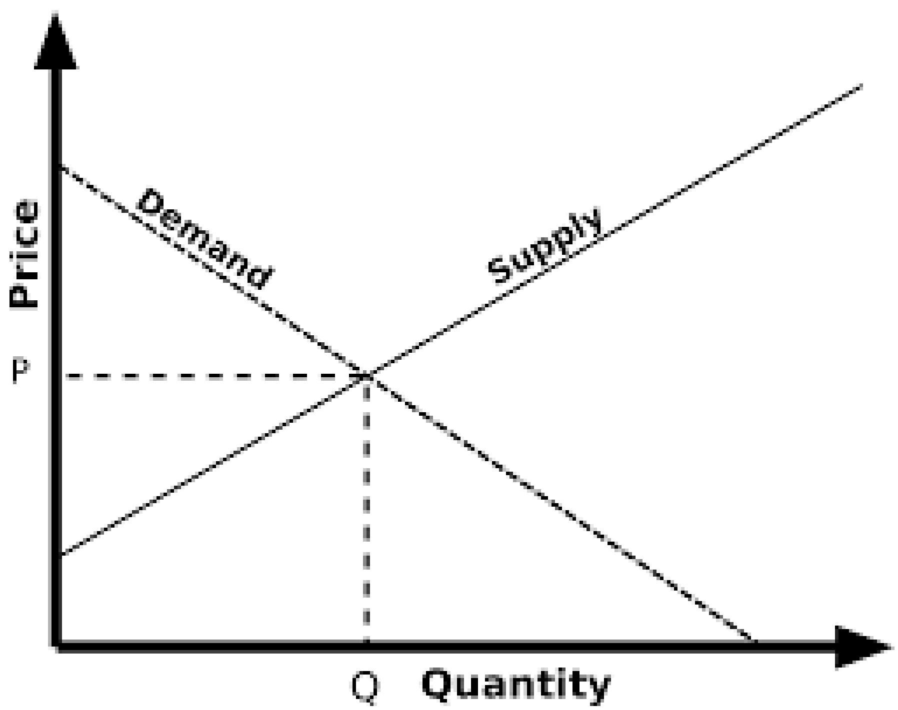

Figure 6: Price mechanism in economic markets

Under the Efficient Market Hypothesis (EMH) this price is supposed to reflect all available information, and as such consistent alpha generation is impossible, meaning one cannot systematically earn returns that exceed the broad market as a whole, rendering the market “unbeatable”. However, this is only true in perfect and frictionless markets where expectations about the future of a stock are instantly discounted into its price, which (un)fortunately is generally not the case in real markets. Explaining how in practice it is possible to create price movements in an asset that do not necessarily reflect the available information or expectations on that stock.

To that end, wagering traders must use the basic price determination mechanism to their advantage, meaning in order to generate upward price pressure they must create excess demand and ideally limit supply of the target stock. To achieve this they have basically two instruments which are available even to the most unsophisticated of traders: stock and call purchases.

Stock purchases allow traders to enact a “buy and hold” or position trading strategy which consists in buying stock and holding it for long periods of time regardless of fluctuations in the market in order to realize future price appreciation. In this case, however, it is used with a much shorter-term scope. The strategy is supposed to be twofold, first, the coordinated buying aims to generate an excess demand for the underlying, and secondly, by holding traders hope to put a strain on supply as well as render the stock increasingly harder to borrow, all together generating an upward pressure on price.

It must be noted however, that the second tranche of the strategy might not always be effective as brokers might still be able to lend their users stock due to the contract that must be signed by the users in order to open a margin account. It is true however for all cash accounts and even some margin accounts which allow user to refrain from lending their stocks. Also crucial for the strategy is coordination among traders, as uncoordinated purchases are unlikely to have the desired effects, as they lack the momentum and volume necessary to trigger an increase in prices.

Nevertheless, what can prove to be an even more effective strategy in generating a rise in price is the purchase of out of the money calls. By buying calls, the trader can create a larger upward price pressure in the underlying than they could otherwise by simply purchasing shares. Since, as price rises, previously out of the money calls turn into at the money calls, forcing short sellers to buy the underlying stock in order to hedge their position. Action which in turn triggers further price increases and (hopefully) initiates a self-fulfilling gamma squeeze, jumpstarted by an initial price surge due to increased asset demand.

It must be noted that the capital invested by the short seller hedging their position by buying the expensive underlying is much greater than the one invested by the trader in fairly inexpensive call options. As such the upward price pressure generated per unit of capital invested with call option buying is greater than the one generated with simple position trading.

Identifying short squeeze targets

The execution of these tactics does not guarantee success however, as a certain set of conditions must be met in order for their implementation to be effective. As such one can define a group of criteria for identifying possible "targets", in this case stocks or companies, prone to short squeeze events.

As stated, a short squeeze is a case of contrarian investment that bets against the general market belief that the price of a certain security will continue to drop in the future. Consequently, the respective company must provide some reasons to support this pessimistic belief. As such, target companies generally exhibit one or all of the following aspects: weak financial performance, failing business models or operations in a declining industry. This is clearly illustrated when we look at the 13 stocks that experienced short squeezes at the beginning of 2021, as many of them such as American Airlines, Trivago and AMC operated in the sectors of tourism and entertainment which were greatly hit by the COVID pandemic. Whereas others such as Nokia, BlackBerry and Bed Bad and Beyond exhibited weak performance and failing business models even before the pandemic. In the case of GME, it operated in the declining market of physical game media leading to weak financials as well, just to make a remark on possibly the most important short squeeze target.

In addition to this, this (justified) negative market sentiment must be reflected by a high percentage of shorting activity, which can be measured through the use of two indicators: short interest and days to cover.

Short interest is the number of shares that have been shorted and are yet to be covered or closed out, expressed as a percentage of the total stock float of a company. It is used as indicator for market sentiment, an increase signals that investors have become more bearish, whereas a decrease signals they have become more bullish.

Days to cover on the other hand, also called short interest ratio, is a temporal measure of the expected number of days necessary to close out a company's outstanding shares that have been sold short, that is repurchase all of the borrowed shares. It is calculated by dividing the number of shares shorted by the average daily trading volume over the last 30 trading days. Much like the short interest, it is used by traders to identify trends and general market sentiment as well as future buy pressure. The larger the days to cover indicator is, the more bearish the market is on that particular stock and the highest the buying pressure will be once and if the position must be closed out.

Altogether, stocks that show extreme short interest and days to cover readings are more prone to short squeezes. Since if the percentage of shorted shares with respect to the float is sufficiently high, the closing out of this position by short sellers can trigger a significant upward price spiral, aka a short squeeze. Short interest ratios are usually quite low, large non-financial stocks generally have ratios below 2.5% while for small non-financial companies, the ratio still tends to be below

13%. Rarely does a stock have short interest of 50% or greater on any given date. Generally speaking, a short interest of 30% is already considered concerning but in extreme cases it can surpass the 100% barrier potentially indicating naked short selling and making them perfect targets for short squeezes. Short interest can sometimes exceed 100%, as it did with GameStop, when the same shares are lent multiple times by successive purchasers. This is the case when someone buys a stock from a short seller and later lends out the underlying stock again, thus, for the purpose of the short interest calculation it will appear as the stock has been shorted twice.

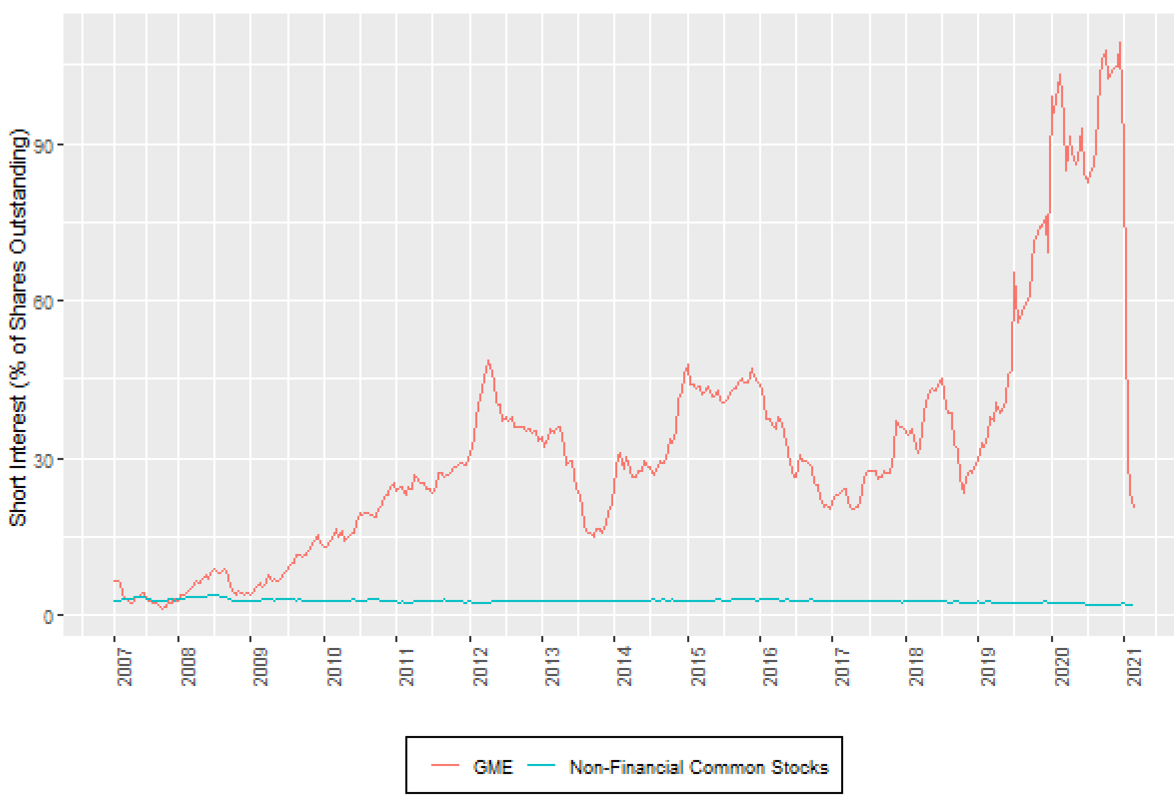

Figure 7: Short interest in GameStop vs. market from 2007 to 2021

Source: SEC

In line with this, there should be a myriad of cheap short-dated call options available for purchase by retail traders. As, like previously commented, they are potentially more efficient in generating upwards price pressure per unit of capital invested than simple stock purchases. Regardless of this, the stock should ideally trade at low values (at least initially) in order to allow for more inexperienced traders, who might lack the margin accounts or knowledge necessary to trade in options, to partake in this speculative action and contribute to the buying pressure of the underlying stock.

To conclude, the last criteria for choosing a possible short squeeze target is its floating stock. The float, calculated as the number of outstanding shares minus any restricted stock, refers to the regular shares a company has issued to the public that are actually available for investors to buy and sell. For a short squeeze to be plausible the float of the target company and its capitalization, intended the number of outstanding shares times their price, should be relatively small. This has foundation on a couple of factors. Firstly, the smaller the float and market cap of the company, the greater the impact on price that a group of coordinated retail traders might be able to achieve by implementing the mechanisms mentioned above. Secondly, the impact on price from the closing-out or hedging of institutional investors' short positions is also greater the smaller the float is for any given level of short interest on the underlying share. Lastly and most importantly, is the fact that the size of a company's float is inversely correlated to the volatility in its stock price, the smaller the float, the higher the volatility is. As such there is a higher chance of rendering deep out of the money calls into in the money calls as the price swings in the underlying asset are bigger. This is beneficial for the wagering traders as these price swings can trigger short sellers to hedge or close out their positions, ideally initiating gamma or short squeeze events.

VW 2008 Short Squeeze

One of the first and probably most well-known instances of a short squeeze is the (in)famous 2008 Volkswagen Short Squeeze, behind which many of the more recent traders rallied to base of their assumptions and use as an example of a best-case scenario to motivate other reluctant traders.

This event can be tracked back to September 2005 when Porsche group initiated its gradual and slow takeover of Volkswagen. Takeover that took place over a period of three years between September 2005 and October 2008 were Porsche targeted Volkswagen's ordinary stock. Leading to a constant increase in the ordinary stocks' price which completely ignored the doom and gloom of financial markets during the 2008 crisis due to Porsche's consistent demand.

Figure 8: Volkswagen's ordinary and preference share price from 2000 to 2008

Source: FT

In the meantime however, Volkswagen’s preferred stock, which offered guaranteed dividends but no voting rights and thus was untargeted by Porsche’s demand, continued to fall in price, in line with current market trends. Resulting in an unparalleled gap between the two types of stock, as the preferred share traded at a great discount in comparison to the ordinary stock. Situation that exacerbated as the completion of the takeover drove nearer, with the preferred stock trading at less than half the price of the ordinary one.

Figure 9: Volkswagen’s preference shares as percentage of ordinary shares from 2000 to 2008

Source: FT

This event was seen as a unique chance for event driven traders who saw a great opportunity in the misprice of the shares driven by the ongoing takeover. As such many implemented a capital structure arbitrage strategy, shorting the overpriced ordinary stock and going long on the undervalued preferred one. Hoping that since both should reflect assumptions about the company's future they would tend to collapse at some value in between once the market imperfection was corrected. Due to the sheer size of the gap between the two, this was seen by many hedge funds as a riskless trade, leading to some 12% of all Volkswagen's ordinary stock being sold short by the end of September.

Short interest which by itself wouldn't have been too worrisome, as it was still far lower than the 30% threshold to be considered concerning and a pigmy when compared to more recent examples. Yet on Sunday October 26th 2008 Porsche announced that it held 42,6% of the Volkswagen ordinary shares in addition to 31,5% in cash settled options relating to Volkswagen ordinary shares to hedge against price risks. With which upon settlement Porsche would receive in cash the difference between the then actual Volkswagen share price and the underlying strike price in cash, buying Volkswagen shares in each case at market price. All together representing a total of 74,1 per cent, which when coupled with Lower Saxony's 20% holding meant the shares available to buy on the open market were just under 6% effectively cornering short sellers. Although its plan to takeover Volkswagen was well known, the extent of it was not and Porsche had been able to build up its position in secret, as they were no laws in Germany which forced them to disclose their holding.

This was a terrifying prospect for the shorts, who concluded that they could be caught in an infinite squeeze in which they were forced to buy shares at any price. As such their buying frenzy sent Volkswagen's share price soaring. Briefly making Volkswagen the highest capitalized company in the world at the time at $420bn when the intraday price of the stock arrived at €1000 for a brief moment.

Figure 10: Volkswagen's ordinary share prices during 2008

Source: FT

This frenzy only saw an end on the October 29th once Porsche "generously" decided to settle Volkswagen options amounting to around 5% of the ordinary shares, providing some relief to the stricken shorts. As a result, by the end of the week, Volkswagen's ordinaries closed at €497, down 50 per cent from the maximum highs as the squeeze loosened.

When all was said and done, hedge funds who had shorted the ordinary stock had lost billions whereas Porsche had made billions in financial profit, dwarfing even its proceeds from car manufacturing. In what is now known as one of the greatest wealth transfers of all time.

GME Short Squeeze

Having looked at the most well-known case of a "textbook" short squeeze we can then move on to the more recent examples of meme stocks. In particular it is interesting to analyze what happened with GameStop as it was the stock experiencing the biggest surge in price during the squeeze, up to 28 times on a year-to-date basis, and also the focus of most media attention and retail trader activity.

GameStop is an American company consisting in a chain of video game stores which operates mainly in the market for physical game media. Market which has been in a steady state of decline ever since competition from digital game services such as Xbox Live, PlayStation Network, and Steam among others was introduced. This fact coupled together with the economic effects of the COVID-19 pandemic, which drastically reduced the number of people shopping in physical stores, meant that, before being the focus of media attention, GameStop's stock price had been consistently declining ever since the end 2017 when it recorded its first significant holiday season drop in sales of 16,4%.

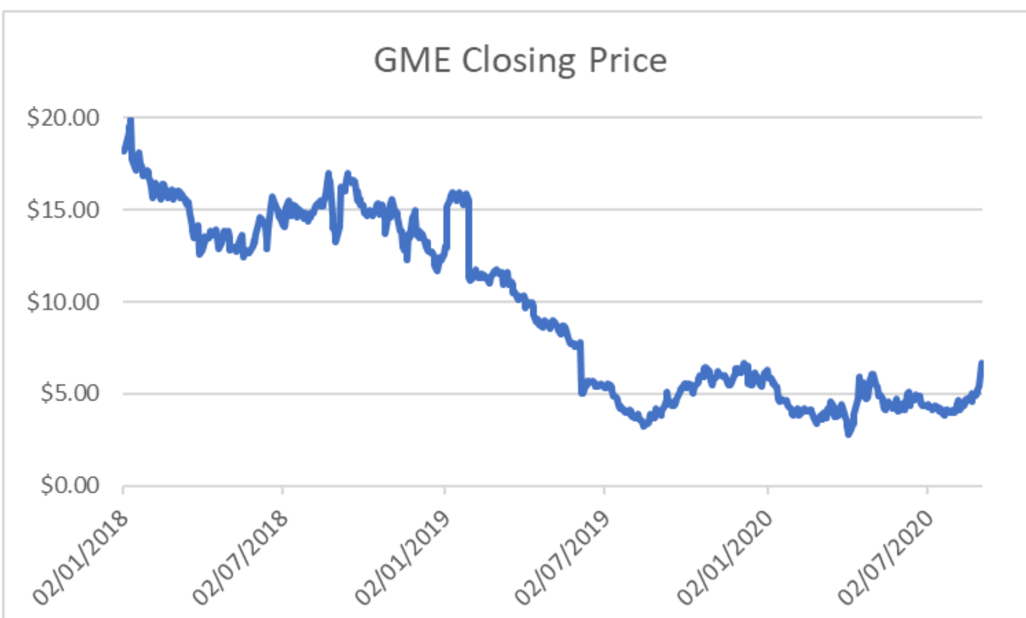

Figure 11: "Pre-Squeeze" GME closing price

Source: Yahoo Finance

As a result, many institutional investors picked up on GameStop's decreasing financial performance. Meaning the stock was heavily shorted during the pre-squeeze period, arriving at a peak short interest as percentage of float of 122,97% during January 2021 far exceeding that of other meme stocks.

As a counterpart, this meant there was plenty of contracts available to trade with GameStop stock as the underlying. In fact, for the first 3 quarters of 2020, GameStop options traded at a median of about 16.000 contracts per day, with a maximum amount of contract traded in a single day being of about 172.000. The dollar volume instead had a median value of just over $800.000 per day and a single day maximum of about $42 million. This trend got stronger in the fourth quarter of 2020, with GameStop options trading at a median of about 84,000 contracts per day and a single day max of about 560.000 contracts. Accordingly, daily median dollar volume was approximately of $10,5 million for that period, with a maximum of about $120 million in a single day.

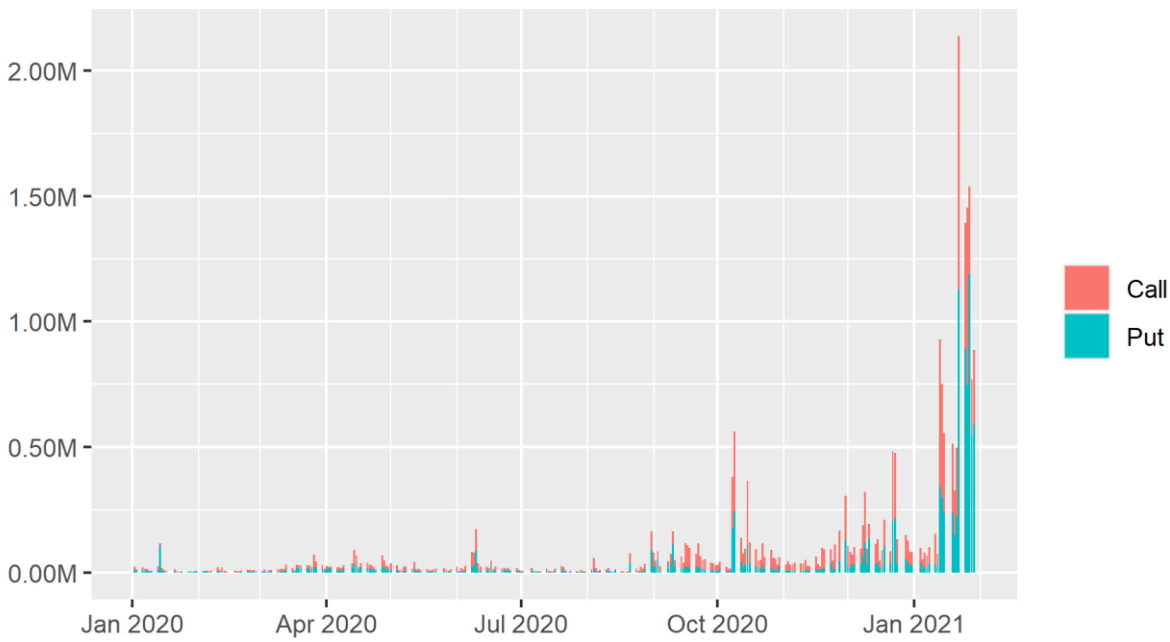

Figure 12: GME options contract volume during January 2021

Source: SEC

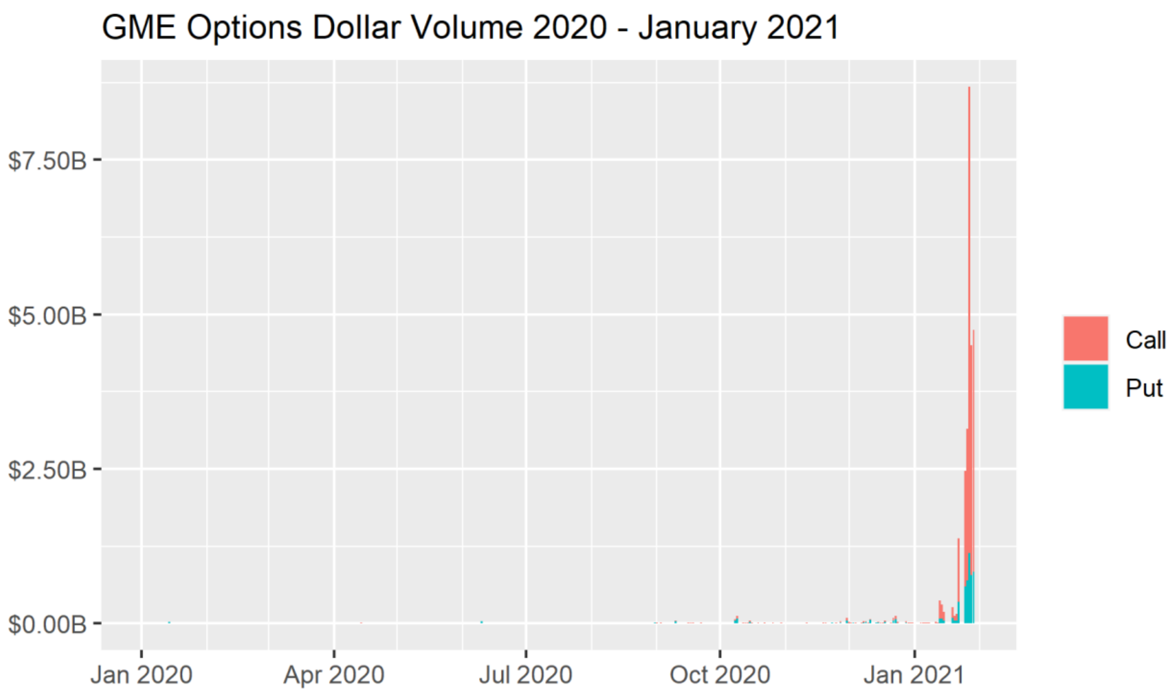

Figure 13: GME options dollar volume during January 2021

Source: SEC

As a final note, GameStop was a relatively small-capped company at around $250 million on July 2020 before it got any media attention and around $1000 million in December 2020 as it was beginning to be the focus of media attention and trader activity. Furthermore, the small market cap was coupled with a somewhat small float, which was made worse in 2019 when the company repurchased a significant amount of shares in response to its low stock price. Meaning these repurchases increased the short interest as the float decreased but the shorting activity remained the same.

In short, GameStop ticked all the boxes for a perfect short squeeze: a failing company with a small capitalization and float, a reigning pessimistic sentiment on the stock which lead to high shorting activity and plenty of options for traders to bet on. And this did not go unnoticed by them.

Starting January 2021, GameStop became the center of attention of many online trading communities, the most important of which Reddit's subforum r/WallStreetBets. Where a series of somewhat financially savvy users, in particular Keith Gill under user u/DFV, argued through both fundamental and technical analysis that the stock was undervalued. Presenting GameStop as way to sabotage the short positions held by powerful hedge funds and "sticking it to the Man" through the means of a short squeeze, were their coordination attempts to be successful. This increased interest was not unnoticed by media outlets which soon started to report on the rebellious traders and their David versus Goliath struggle. It even prompted institutional investors to comment on the situation, calling Reddit traders "suckers" and supporting their bearish views. All things that only contributed to fuel the craze even further.

Figure 14: Citron's comment on GME buyers

Source: Twitter

As a result, hundreds of thousands of new traders flocked into the stock during the month of January. As the count of individual accounts actively trading GameStop shares surged from just under 10.000 at the beginning of the month of January to just shy of 900.000 by the end of it. Users who accounted for more than 3 million daily trades and a dollar volume of almost $30 billion at peak.

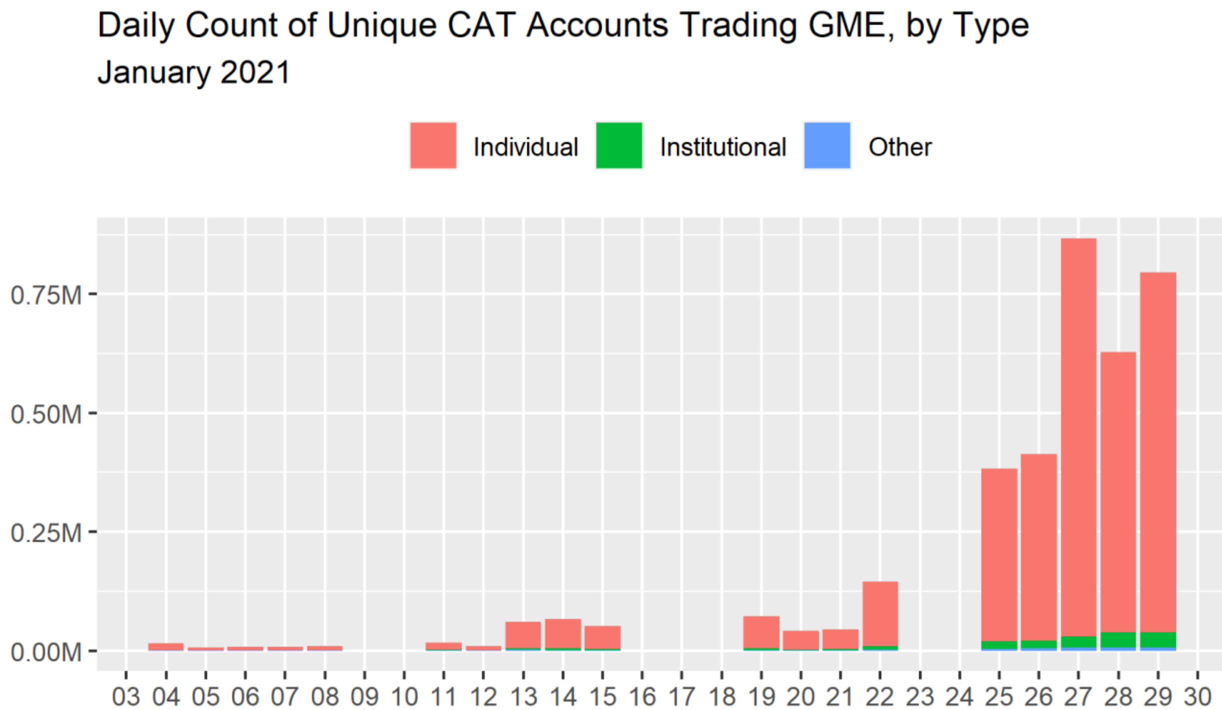

Figure 15: Daily count of unique CAT accounts trading GME by type during January 2021

Source: SEC

All this influx of new traders had a negative impact on market quality. First, liquidity declined significantly, as the bid ask spread increased substantially during January, arriving at an effective spread of 0,54% at peak and a nominal spread almost 50 times larger than that of 2020 on average. This was also accompanied by drastic decrease in the size of the best bid, going from a median of 4.720 shares in 2020 to just 19 at peak in January. Meaning the market became much more shallower during the month of January.

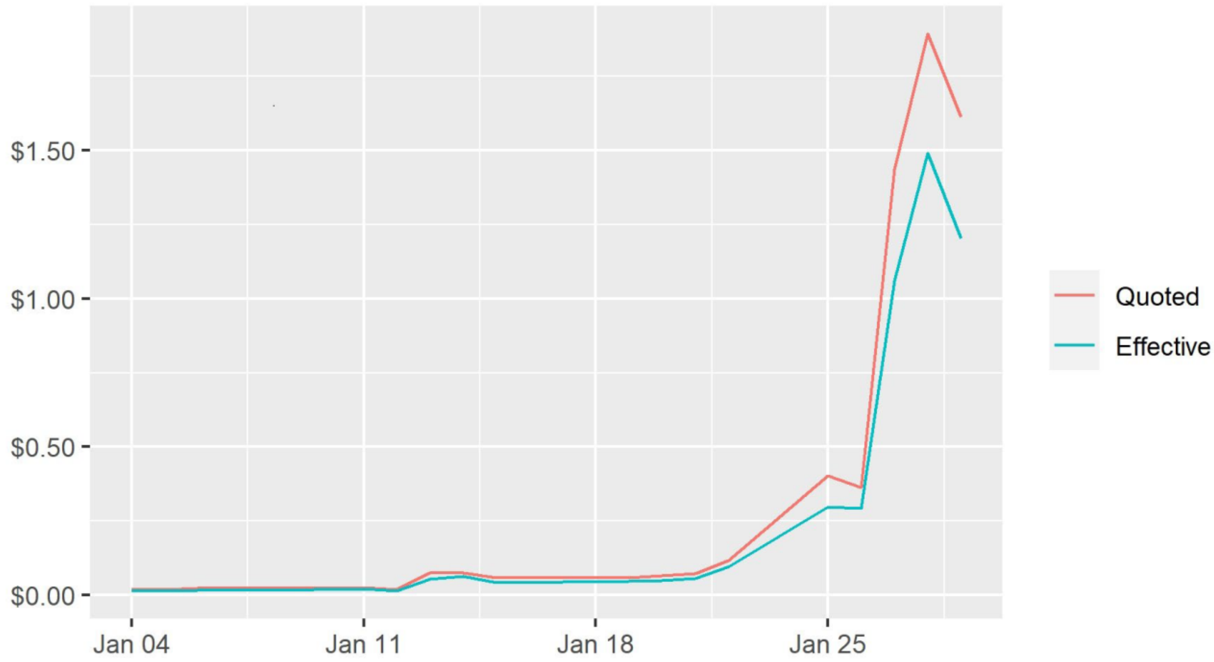

Figure 16: GME nominal quoted and effective spreads during January 2021

Source: SEC

This also had an impact on the volatility of the underlying, which increased more than a 100% during the month. Fact that served the wagering traders aiming for a short squeeze just right, as bigger price swings meant a higher chance of rendering deep out of the money calls into the money. Thus exuberating the dimension of the possible squeeze.

This tremendous influx of new traders who relied mainly on stock and call option purchases to express their optimistic views caused the stock price to increase in January during the days prior to the squeeze. This process was arguably aided by the options counterparties who likely increased their hedging by buying the underlying shares as the price of the stock and call demand increased, which in turn should have had a significant positive price effect on the stock as well. As a result, stock price went from just $17,25 on January 4th to $76,79 by the 25th, an increase of more than four times in just the short span of 3 weeks.

This sudden price increase arguably led to a short squeeze by the end of January. As GameStop shares arrived at an all-time high of $483 on January 28th, representing an increase of more than 2700% when compared to the closing price of $17,25 on January 4th. In support of this idea is the fact that this surge in price coincided with a drastic decrease on the short interest on the stock, going from 115,65% on January 25% to "just" 43,79% by February 1st, meaning the number of shorted shares was reduced by more than a half during the spike. We can argue then that the initial price increase forced short sellers to close out their positions by purchasing the underlying stock thus contributing to the buying pressure and the subsequent surge in price.

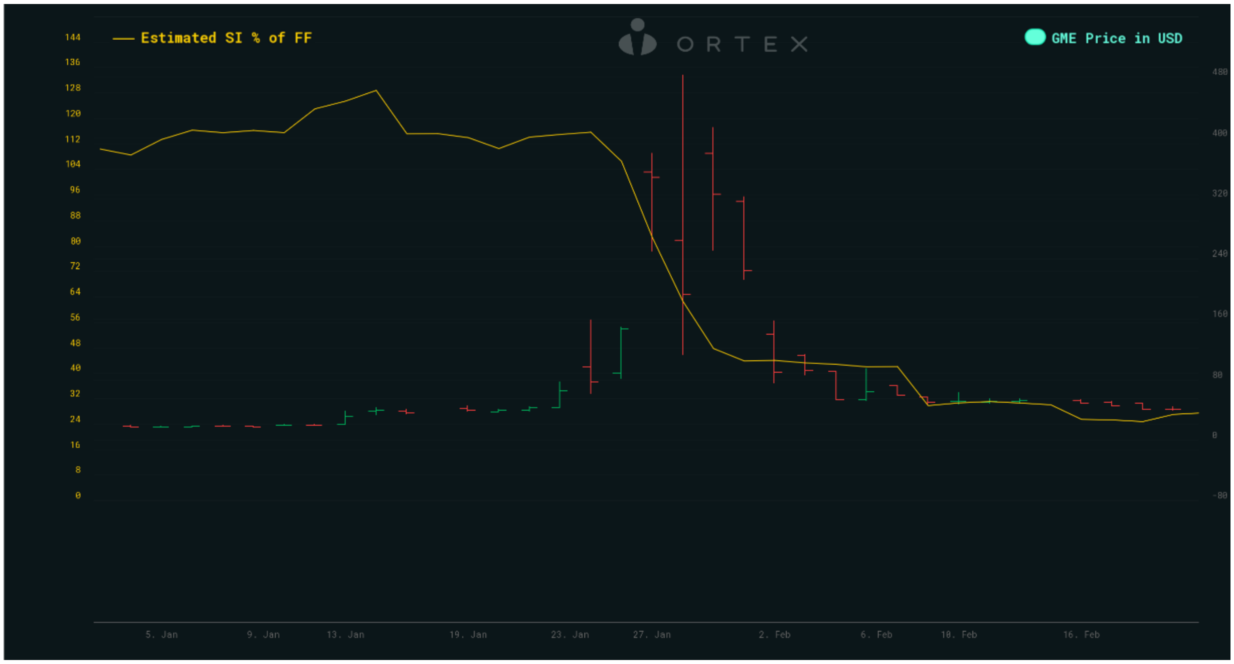

Figure 17: GameStop share price and short interest during January 2021

Source: Ortex

In line with this, is the fact that GameStop made it to NYSE's threshold list for 18 consecutive days out of the 20 trading days of January. Meaning its transactions failed to clear as the aggregate fail to deliver position extended for five or more consecutive settlement days. This fact coupled together with the extremely high short interest on the stock could be considered an indicator of naked short selling. Which would in turn help explain the incredible rise in price, as short sellers, not having procured or arranged to procure the underlying in advance, would have been forced to cover their position at any price. Thus exerting significant upward pressure on price through the buying action. Nevertheless, it must be noted that, although used as an indicator of market manipulation by the SEC, consistent fail to deliver could be also attributed to more mundane factors such as technical anomalies or human error.

This frenzy was short lived however, since after peaking on January 28th the volume and price of GameStop shares decreased substantially, dropping to below $100 by February 3rd. This downturn corresponded with retail brokers with a largely individual investor customer base imposing trading restrictions on GameStop as well as other notable meme stocks which were experiencing high levels of volatility. Meaning customers could no longer open new positions in the stock although they could still close them, thus severely impacting buying pressure. In fact, the volume of shares traded dropped from around 180 million on January 26th to just a little over 37 million by February 1st, meaning trades reduced almost five-fold.

These trading restrictions were seemed by individual traders as broker-dealers succumbing to the pressure from hedge funds and their commercial partners. Nevertheless, discount brokers attributed these restrictions to margin calls and capital charges imposed by clearing houses in order to guarantee the proper settlement of their customers' orders in response to the extraordinary volatility experienced by the stocks.

All in all, it is obvious that the stock experienced price movements in line with that of a short squeeze, however, when looking deeper into it one might find that it cannot all be attributed to short sellers closing out their positions. Although it is true that GameStop shares had sharp price increases concurrently with major short sellers covering their positions by buying large volumes of GameStop shares, accounting for very significant portions of the net buying pressure during the period extending from the 22nd to the 27th of January. These acquisitions were a small fraction of overall buy volume, and GameStop share prices remained high even after the direct effects of covering short positions were finished. Thus the price contribution of these purchases fell short to those of retail investors motivated by the desire to maintain a short squeeze. Meaning it was the positive sentiment of retail traders and not the buying-to-cover action of short sellers, that sustained the consistent price increase of GameStop stock in a self-fulfilling prophecy of sorts.

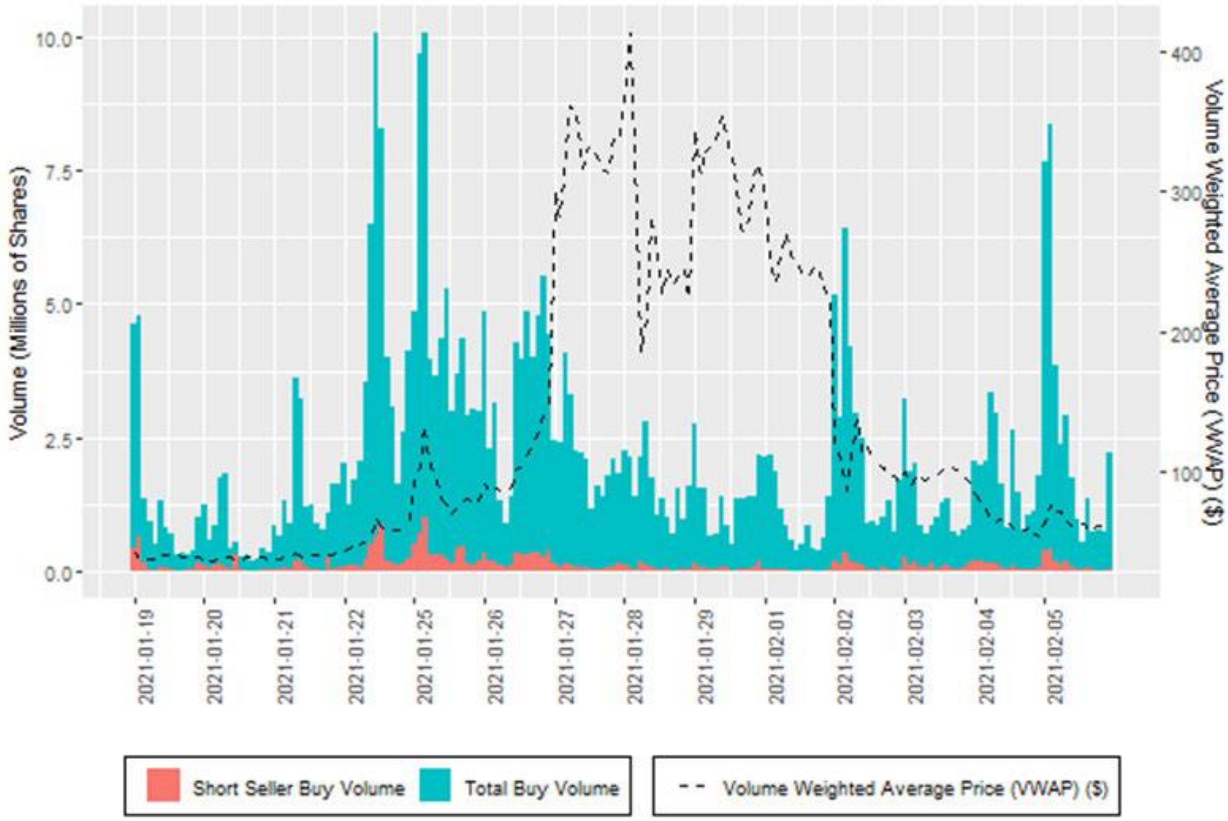

Figure 18: Buying activity of traders with large short positions in GameStop from January 2019 to February 2021

Source: SEC

What remains true is the fact that after all was said and done, institutional investors betting on GameStop demise experienced significant losses during the months of January and February, just to give an example, Melvin capital sustained a fall of $4.5bn in its assets accounting for %53 loss when compared the end of the previous year. Meaning that regardless of the reasons behind the surge in prices, retail traders achieved their goal of cornering short sellers and robbing them of their profits. In both a sentimental and economical victory, as the more cunning traders were able to pull off insane profits from this unprecedented move.

Facilitating Factors

One question that could be posed is why these kinds of events have become relevant only as of recently. In fact memes have been a phenomenon for quite some time now and the stock market has been no stranger to countless speculative attempts, so why are we just only now seeing these two worlds collide? The answer lies in a series of factors which we analyze next.

Discount Brokers

Probably one of the main structural factors behind the rise of meme stocks has been the introduction of “Discount Brokers”. These brokers have eliminated all transaction costs as they generally offer commission free trading as well as no account minimums, allowing for a greater number of less wealthy investors to get into trading and participate in the market. Such feat has been achieved by a diversification of their revenue stream as discount brokers rely on payment for order flow as their main source of income. This action involves redirecting client orders to market makers for execution, as market makers profit from the bid-ask spread and in turn rebates a small portion of this profit back to the routing broker. The payment is usually fractions of a penny per share but a high volume of trades and a low overhead, due to most discount brokers operating exclusively online, as well as other sources of revenue stemming from advisory services, interest earned on margin loans and cash deposits, income generated from securities lending and fees from additional services allows them to run a successful business model.

As a result, individual investors are able to access the market through cash or margin accounts at these brokers. In cash accounts the customer must pay the full amount for securities purchased, whereas on a margin account, the broker con loan the investor money with the securities in the customer’s account acting as collateral. Meaning traders with a margin account can use this money to purchase securities, sell securities short, or cover transactions in case their cash balance falls below zero as well as trade different types of options. Nevertheless in order for a customer to be able to open a margin account and trade option the broker must first conduct due diligence that option trading is appropriate for the individual client. This is often done by requiring customers to obtain specific approval to open margin account, generally by completing a simple questionnaire regarding the customer's investing experience, financial situation and risk tolerance.

This has brought an extensive assortment of financial options to all traders, not just institutional investors as in the past. As a result, the odds of significant financial market influence with fewer available financial resources has been increased with this broad availability of leveraged options. Meaning now small traders in large enough groups could in practice generate profound effects on markets through the use of use of leverage and coordinated action. As such, discount brokers were the tool of preference for the wagering traders during the squeeze, with probably the most relevant example being Robinhood.

Robinhood is an online broker tailored to inexperienced traders via an easy-to-use platform, its mission being to "provide everyone with access to the financial markets, not just the wealthy". Like with all other discount brokers, trading on the platform is commission-free, and Robinhood makes a profit out of other sources of revenue, mainly payment for order flow and other premium services. As mentioned, being the tool of choice for meme trades, Robinhood experienced significant growth during the squeeze, in fact just in the month of January their app was downloaded more than 3 million times. This all meant than when compared to March 2020, the platform more than doubled its funded user base going from 7,2 million to 18 million in March 2021 and more than quadrupled its assets under custody going from $19,2 billion to $80 billion in the same period. An incredible increase fueled by the retail trading craze.

It is important to note as well that one of the most important contributions of discount traders has been the introduction of a younger and less wealthy audience to the trading arena. This is evidenced by Robinhood, which reported its average customer being 31 years old and having a median account balance of just $240. This has been further exacerbated by an increasing gamification of broker services aimed at capturing a younger demographic. In fact these brokers include a number of features such as behavioral prompts, differential marketing, game-like features designed to engage individual investors.

So all in all discount brokers have had not only a significant impact on the volume of trades by allowing a higher degree of the population to participate on the markets through the elimination of transaction costs. But possibly impacted market quality and facilitated these phenomena as well, as young investors are less financially literate and more prone to behavioral mistakes.

Online Forums

While discount brokers have been the mean for the meme stock phenomena to take place, the reason behind it has probably been online trading forums, in particular Reddit's r/WallStreetBets. Which have played a crucial role in the coordination attempts of individual traders as they have an outreach of millions of retail investors. Meaning popular investing ideas, such as that of targeting hedge funds short positions in this particular, can propagate in no time.

In fact, when looking at r/WallStreetBets we can see that its user count skyrocketed during the squeeze period of January, in contract with the steady increase in users it had been experiencing since its creation in 2012. Going from "just" 1,76 million users at the beginning of the month to over 8,5 million by February 4th, a whopping 380% increase in just the span of a month. Surge that placed it among Reddit's top 50 most popular subreddits at that time.

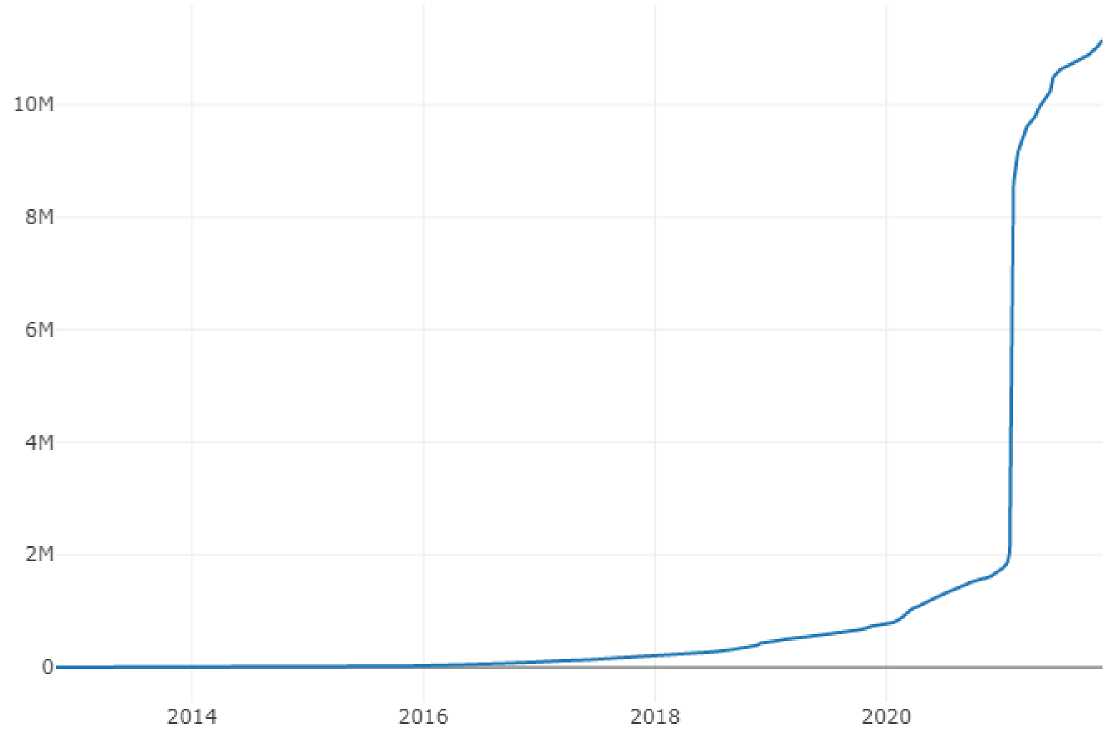

Figure 19: r/WallStreetBets user count

Source: Subreddit Stats

The same is also true for comments and posts made on the forum, which also saw significant increases during the month of January. Peaking at 394 thousand comments and 68 thousand posts made in just one day during the 28th of January. Date that coincides with the peak price of GameStop stock and also the start of trade restrictions imposed by the discount brokers.

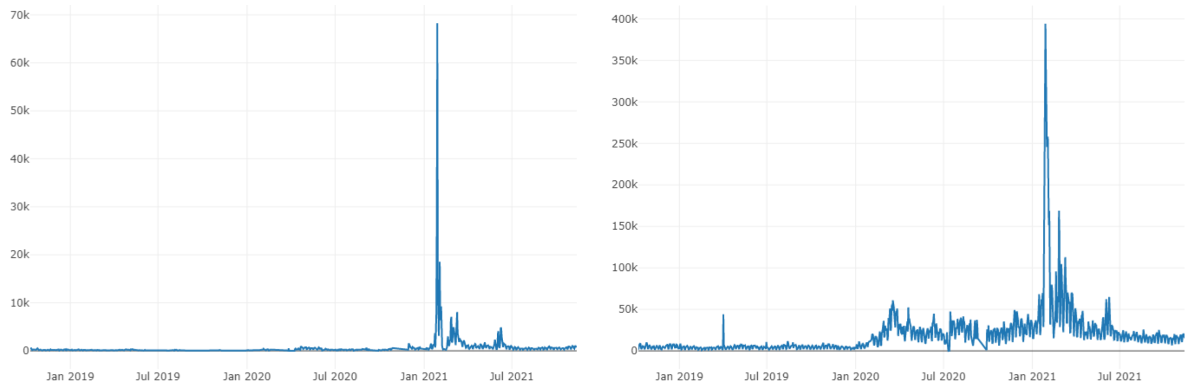

Figure 20: Daily posts (left) and comments (right) count on r/WallStreetBets

Source: Subreddit Stats

Although the forum was not exclusively focused on GameStop, during the time of the squeeze all other topics other than that were dwarfed by its popularity. This is evidenced on the forum's all-time list of top posts by upvote count which consists exclusively of post related to GameStop and the information regarding the short squeeze.

Undoubtedly trading forums such as r/WallStreetBets have provided a platform for millions of users to share their investing ideas and coordinate their actions in order to have more impactful effects on the markets. But what is perhaps more interesting about these trading forums is the fact that they have facilitated for other social phenomena which in turn have exacerbated the meme stock phenomena, mainly feedback models, biased self-attribution and echo chamber effects.

The first one is part of the price-to-price feedback theory which aims to explain price increases diverging from the fundamental value of a stock. When the price of an assets rises, it creates successes for some investors with long positions, which in turn attracts public attention, generates enthusiasm through the word-of-mouth, and increases expectations for additional price increases in the future. This process is self-fulfilling as this excitement grows investor demand, leading to further price increases. Thus creating a feedback loop which if not interrupted may lead to a speculative bubble, where very high current prices are supported by high expectations for further price increases. These high prices are unsustainable in the long run, since they lack any kind of fundamental reason behind them, and as such the speculative bubble ultimately pops, with prices falling down and reverting back to fundamentals

This mechanism describes the price movement of GameStop during the short squeeze pretty precisely. Nevertheless, it is not the only one in place as, like it has been discussed before, some of the price increase can be attributed to the closing out of the short positions by institutional investors.

The other self-reinforcing mechanism present on these forums as well is that biased self-attribution, which is the human tendency to attribute events that confirm the validity of their actions to their own high ability, in contrast attributing events that disconfirm their actions to bad luck or sabotage. Meaning individuals become more stubborn and thus the effect of reinforcing price dynamics is stronger. This could be witnessed when trading restrictions were imposed, and forum lurkers blamed it on the brokers succumbing to external pressure and not to their actions causing unbearable levels of volatility.

Finally, as with all social media these forums are subject to echo chamber effects, meaning existing beliefs are amplified or reinforced by communication and repetition inside a closed system which is insulated from any outside influence. As such, by participating in an echo chamber, individuals are able to reinforce their existing beliefs without encountering contradictory information or opposing views, thus ultimately falling into an inadvertent exercise of confirmation bias. Exercise which further intensifies reinforcing price dynamics allowing a group of stubborn coordinated traders to drive the stock market largely independently of fundamentals.

Covid Implications on Retail investment

The last notable factor giving rise to meme stock was the Covid pandemic which forced people to stay at home and find new ways to fill up their time, resulting in many pouring their interest into the stock market. In fact, once the lockdown was put in place, people were forced to stay at home most of the time, meaning their attention to and participation in financial markets was expected to increase significantly. This is in fact true, as retail trading took off amid the Coronavirus crisis with major brokerage firms registering record new accounts in the first half of 2020. As an example, Robinhood saw a record three million new accounts open during said period and three times its average trading volume when compared to 2019.

But the most important by-product of the pandemic affecting trading was probably the Coronavirus Aid, Relief, and Economic Security Act a $2.2 trillion economic stimulus bill passed in 2020, to combat the economic fallout of the COVID-19 pandemic in the United States. Which notably included $300 billion to be allocated as one-time payments of $1200 to individual persons submitting a tax return in the USA with an annual income lower than $75000. As such, all this “free money” arguably triggered house money effects. Which is the tendency of investors to take on greater risk than they would when investing their savings or wages, as people think of this differently from the money they earned in other ways, distorting their mental accounting. Making them more predisposed to venture into riskier bets such as meme stocks.

As such, increased savings and availability of convenient easy-to-use discount brokers, lead to a significant increase in retail stock market participation and trading activity throughout the lockdown period.

Conclusion

Born in trading forums, jump-started by the COVID pandemic, and brought to life by discount brokers, the meme stock phenomenon has proven to be a force to be reckon with. As this unprecedented event has seen many well-established institutional players lose billions in the hands of a group of stubborn well-coordinated retail traders with a personal grudge against them. Undoubtedly cornering their short positions and forcing them to close them at a sizeable loss. And although the effect of this purchase-to-close action on prices by short sellers might have been dwarfed by that of retail traders stubbornly buying and holding the stock in an obstinate desire to maintain a squeeze, the fact remains that the influence of individual investors on the stock market is ever increasing. As a result of new brokerage business models have allowing more and more people to participate on the markets by eliminating both entry barriers and transactions costs, and investing forums providing them with savviness and facilitating their coordination.

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