

The effects of the new type of large trader.



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Abstract

The goal of this study is to research to what extent the market behavior of the GameStop short squeeze differs compared to other short squeezes. This comparison is made with the Volkswagen and KaloBios short squeeze. The data consists of panel data ranging from 2008 to 2021 is collected from the Refinitiv Eikon database with an addition of the S&P500 data, which is collected from Stooq. For four hypothesis regressions are run using a random effects model and one hypothesis is tested mathematically. As for the question to what extent the market behavior of the GameStop short squeeze differs from the other short squeezes results suggest the new type of large trader to have a positive effect on the trading volume, a negative effect on the price volatility, a negative effect on the stock return, no effect on the price reversal and mathematical calculations prove that the trading volume of the GameStop short squeeze was more “smooth” than the other short squeezes. Altogether this study shows a significant difference between the market behavior of the GameStop short compared to the other short squeezes.

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1. Introduction

Despite the already extensive existing literatures regarding short squeeze an anomaly occurred in January 2021. This short squeeze was initiated by an online community, namely the users of the subreddit r/wallstreetbets, resulting in an asset bubble. A Subreddit is a user-created communities devoted to discussing certain topics on the social news website Reddit. An asset bubble is a situation in which the price of an asset strongly exceeds the asset's intrinsic value, for example because of implausible or inconsistent views about the future of the asset (Jarrow et al., 2007). The r/wallstreetbets subreddit (<https://www.reddit.com/r/wallstreetbets/>) was created on 31 Jan. 2012 and has roughly 10 million members. In the end of January, WallStreetBets exploded into the mainstream, moving from the front page of Reddit to the front page of the New York Times and nearly every other major news site. The subreddit's short-squeeze of GameStop helped shoot up the price of the video game retailer's stock a mind-boggling 1,700% from the beginning of January to the 27th of January (before it fell again the day after), captivating the minds and wallets of investors — both casual and institutional — and financial regulators (Sarlin, 2021).

The initiated short squeeze occurred on the stock of GameStop, an American video game, consumer electronics and gaming merchandise retailer. Other securities and assets were also influenced, but the focus of the research will be on GameStop. The GameStop short squeeze caused hedge funds and short sellers to suffer major financial consequences. It is estimated that 140 percent of the GameStop's public float had been sold short, meaning that more stocks were sold short than the number of shares that was in the hands of public investors opposed to locked-in shares. The fact that more stocks were sold short than were available caused a rush to buy shares to cover the short selling, which created a bubble on the stock price. At its highest, on January 28, the short squeeze caused the stock price to reach a pre-market value of over 500 USD per share, which was nearly 30 times the 17.25 USD valuation at the start of the month. With large price jumps from 76.79 USD to 147.98 USD to 347.51 USD on the 25th, 26th and 27th of January, respectively.



Figure 1. GameStop Corp. price developments and volume. (GME | GameStop Corp. *Cl A Advanced Charts*)

On the 28th of January, some brokerages, halted the buying of GameStop and other securities which attracted criticism and accusations of market manipulation from prominent politicians and businesspeople from across the political spectrum. The halting of buying stocks resulted in class action lawsuits being filed against the brokerages. What is particular is that the halting is believed to have spread out the frenzy over to other assets. For example, in reaction to the halting the combined market capitalization of all cryptocurrencies increased over 1 trillion US dollars, with the value of Dogecoin (DOGE), increasing over 800% (Cuthbertson, 2021; Kharpal, 2021). This occurred due to the “chairman” of WSB twittering “Has Doge ever been to a dollar?” at 6.13 am on the 28th of January (*The Chairman on Twitter: “Has Doge ever been to a dollar?” / Twitter, 2021*). We also see a dip of GME on the 28th of January in both the price and the volume, whilst the price and volume of Dogecoin increased a lot.

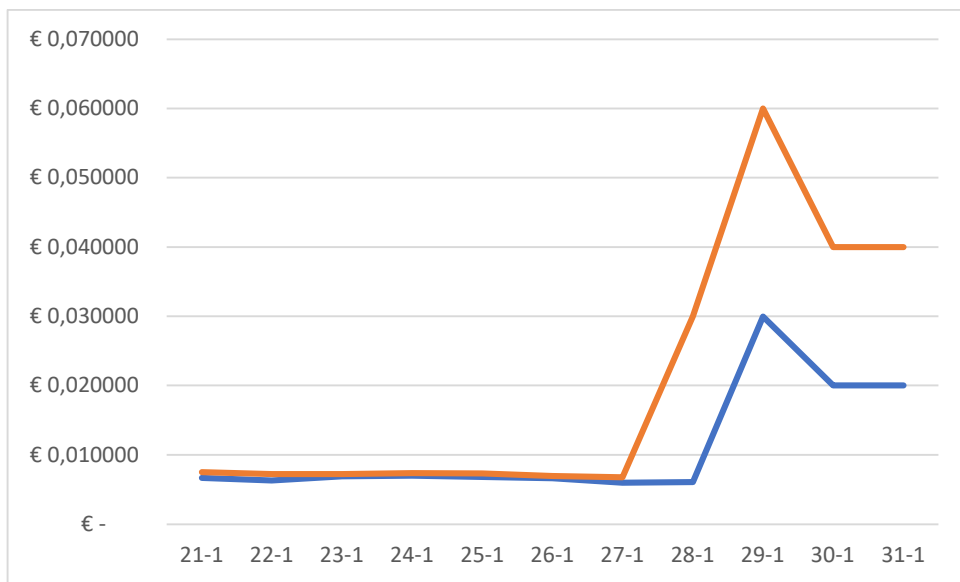


Figure 2. Dogecoin price development including the high price, orange line, and the low price, blue line. (Coinmarketcap)

Looking at DogeCoins price development, volume and market cap it shows a large increase on the 28th of January. With an average daily trading volume of 150 million euros the week prior to the 28th of January, at the day of the halting the daily trading volume increases by nearly 6.000% to roughly 9 billion euro and 21 billion for the 29th of January (*CoinMarketCap*). In figure 3 the price developments of Dogecoin are compared to Bitcoin, the market leader of cryptocurrencies, showing that Dogecoin outperformed Bitcoin. This can be seen as Dogecoin outperforming the market and one might assume that the increase in value of Dogecoin was not caused by the crypto market but by an external force, which in this case is believed to be the halting of the GME stock combined with the twitter post.

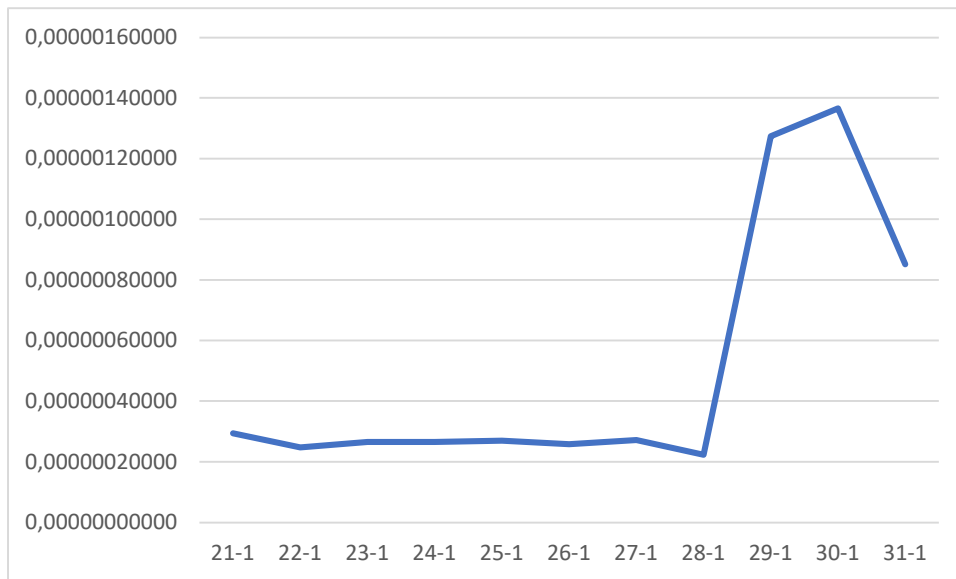


Figure 3.Open price of DOGE/BTC (Coinmarketcap).

Another example is that the shares of GME resources, a tiny mining company located in western Australia, jumped 73% in two days. It is speculated that this was due to a mistake since the mining company uses the same symbol (GME) on the Australian Securities Exchange as GameStop does on the New York Stock Exchange (McGregor, 2021). This bubble and bust of GameStop of the course of less than a month led to short sellers such as Melvin Capital, an investment fund that heavily shorted GameStop, to make major losses. According to data from financial analytics firm S3 Partners, reported on January 26, the market-to-market losses year-to-date were in total over 6 billion USD for the short sellers.

Whilst there have been more short squeezes, such as the Volkswagen short squeeze in 2008, Phillip Falcone on MAAX Holdings in 2012 and Martin Shkreli on biotech KaloBios in 2015 and the last short squeeze of GameStop in 2021.



Figure 4. Volkswagen short squeeze (Godfrey, 2016).

The Volkswagen short squeeze was initiated by Porsche. Porsche did not disclose their option position since it did not require disclosure at all under German law because settlement by cash would not provide stock and therefore not provide control of the company (Godfrey, 2016). By the time Porsche did declare its interests on Sunday 26 October 2008, there was only 5.7% free float due to Porsches holdings, whilst there was a short interest in Volkswagen of around 12.9% of the stock (Godfrey, 2016). This led to the short-sellers being squeezed. Porsche offered a solution to this problem by announcing it would settle options on around 5% of Volkswagen so that counter parties could release enough Volkswagen stock for short sellers to meet their obligations. All this led to Porsche earning a huge profit on the Volkswagen stocks. According to Porsche themselves their financial activities had contributed 6.8 billion euros or around 80% of its 8.6 billion euros pre-tax profit on 31 July 2008 (Godfrey, 2016). Meaning Porsche made four times more money with their investments than they did selling cars. In this paper I study the phenomenon that happened around the GameStop stock since January 2021. What is interesting about the GameStop short squeeze is that it is the first time a short squeeze was not initiated by a large trader or an institution but by a large group of non-institutional investors on a social news website, which has never happened before.

As mentioned before the GameStop short squeeze was initiated by members of the subreddit community "Wallstreetbets". WallStreetBets, also known as WSB, is a subreddit where members discuss stock and option trading. Its popularity comes from their aggressive trading strategies and for their role in the GameStop short squeeze (Greifeld & Lipschultz, 2021). Due to their aggressive trading strategies, which consists of highly speculative, leverage option trading and calling their investments "bets" considered gambling rather than investing according to Jeremy Blackburn, a professor of Computer Science at Binghamton University (*BU Professor sheds light on "Wall Street*

Bets” group from Reddit, n.d.). The forum was founded in 2012 by Jaime Rogozinski, an entrepreneur living in Mexico, who wanted a place where sophisticated investors could swap tips about high-risk, high-reward short-term trading strategies (Davidson, 2018). It is believed that the members of the subreddit see high-risk day trading as an opportunity to quickly improve their financial conditions. During the GameStop short squeeze, their popularity increased. With 1.759.616 members on the 2nd of January 2021 the amount of members increased to 8.462.861 by the 3rd of February (*r/wallstreetbets subreddit stats*, n.d.). The CNN explains WSB exploding into mainstream by the exponential growth of the no-fee option trading app Robinhood, the extreme volatility Covid-19 brought to the markets and the stimulus checks that were handed out to millions of Americans (Sarlin, 2021).

The members of WSB-are likely to bet as much money as possible on the highest possible risk, generally on short-term option. According to Sarlin online movements have shown that internet culture can lead to out of the norm behavior and radical ideas created by people raised on memes (Sarlin, 2021). In the case of WSB this has had a real financial impact. WSB doesn’t only encourage risky trades, it encourages to invest your entire net worth into a risky trade. "It's not even the ends that matter. It's the means. It's the fact that you're placing this bet, that's where the value in all this is. Sure, you may get money, or you may end up broke, but you played the game, and you did it in some crazy way," Blackburn said. To quote Jeremy Blackburn, an assistant professor of computer science at Binghamton University who studies extremist communities on the web, “These guys can move markets” (*BU Professor sheds light on “Wall Street Bets” group from Reddit*, n.d.; Sarlin, 2021).

The main question that will be researched in this study is: “*To what extent did the market behavior of the GameStop short squeeze differ compared to other short squeezes?*”

The key elements of the research question are formally defined in the “Literature review”. However, for the sake of clarity they are also briefly explained here. The main research question consists of three key elements. The first element, *market behavior* consists of the trading volume, price process and volatility. The second element, *short squeeze* occurs when short sellers are forced to buy back stocks from the market to close their position. The third element are the *types of large traders*, which are the one whose trades change prices, can manipulate the market into a market corner followed by a short squeeze, to attempt to generate profits at no risk.

Other short squeezes, such as the Volkswagen, MAAX Holdings and KaloBios were all initiated and or orchestrated by influential businesses or individuals. The Volkswagen squeeze was triggered due to an attempted takeover by Porsche (Allen et al., 2017). The MAAX Holdings short squeeze was initiated by Philip Falcone, which was a billionaire and founder and owner of a hedge fund called Harbinger Capital (Forbes, 2014). The KaloBios short squeeze was orchestrated by Martin Shkreli, a former hedge fund manager and convicted criminal (Rockoff, 2015). What is particular about the GameStop short squeeze is that it was initiated by non-institutional investors, users from the

Reddit community, instead of a hedge fund or billion-dollar company. This difference in types of traders might have affected the short squeeze, which leads to the research question:

To what extent did the non-institutional investors affect the short squeeze on GameStop?

To answer this research question and see how the traders affected the short squeeze a comparison to another short squeeze is required. By comparing other short squeezes, namely the Volkswagen or the KaloBios short squeeze, a suggestive difference can be made on the effects of the new type of traders initiating the short squeeze. This comparison will be done based on market behavior.

To what extent did the market behavior of the GameStop short squeeze differ from other short squeezes?

The aim of the study is to find out how the anomaly of a short squeeze initiated by an online community of non-institutional investors influenced the process. More classical examples have been initiated by influential companies or individuals rather than a large community of speculators. Gaining information regarding the effects of online communities consisting of non-institutional investors will be valuable for existing bubble theories in particular existing short squeeze theories.

1.1 Bubbles background

Price bubbles have fascinated economists for centuries. One of the earliest price bubbles was the Dutch tulip mania of 1634-37 (Garber 1989, 1990), followed by the Mississippi bubble of 1719-20 (Garber 1990) and the South Sea bubble of 1720 (Garber 1990). More recently bubbles on the stock prices were shown prior to the 1929 US stock price crash (Donaldson & Kamstra, 1996; Rappoport & White, 1993; White, 1990) and the NASDAQ dot-com price bubble of 1998-2000 (Brunnermeier & Nagel, 2005; Ofek & Richardson, 2003; Pastor & Veronesi, 2011)

One of the first asset bubbles was the so called “Tulip Mania” (1634-1637), which occurred during the Dutch “Golden Age” when bulbs and tulips reached astonishingly high price levels (Chang et al., 2016). Tulips were traded as bulbs, since transporting the live plants was not feasible. They were becoming a status symbol of successful merchants and until 1634 bulbs and tulips were grown solely by professional growers (Garber, 1989). After 1634 other nonprofessional growers began growing and joined the market. This led to new tulip variants and since the new variants were sought-after the prices for the respective bulbs rose. Since a tulip produces additional seeds and bulbs, which could be sold later, they were acknowledged as a type of investment (Garber, 1989). Because of the seasonal nature of the tulip traders had to work with contracts on tulip bulb futures. These were used to buy and

sell quantities of tulip bulbs that were yet to be produced, at a certain price. When a formal futures market was established in 1636 it was easier to trade contracts. The price of tulip bulbs rose steadily as traders assumed that wealthy foreign families or individuals would always purchase the bulbs. Due to the perception of fashion in tulip varieties and price rises, it was believed by traders that they could always make a profit. In 1637, when traders realized that no one would actually pay for the extremely high prices, the bubble burst with prices quickly declining back to their original pre-bubble price levels (Garber, 1990).

Later bubbles, such as the Mississippi Bubble, South Sea Bubble (Temin & Voth, 2004) and the Dutch Windhandel occurred in the 1720's (Frehen et al., 2013). The burst of the South Sea bubble was so bad it resulted in the Bubble Act, which prohibited companies from trading shares without permission from the government. These bubbles were followed by the "Railway Mania" in 1840-1846, which occurred in the UK. The first railways were demonstrated as an effective method of transporting passengers and goods, and appeared to be a key industry in a time when the country was increasing output of manufactured goods (McCartney & Arnold, 2003). The Bubble Act had just been repealed, enabling railway companies to sell shares without Government intervention (McCartney & Arnold, 2003). Despite the repeal of the Bubble Act, companies still had to get government approval for their routes and permission for land purchases (Odlyzko, 2011). However, the difficulty of constructing the rail projects was only realized later rendering many of the projects unviable, resulting in the speculation and many projects to collapse. This made it seem like the bubble occurred due to the speculation that rail technology could transform transport whilst being profitable. Although later this has shown to be true, due to infancy, limits and returns were unknown which reduced the ability to evaluate projects rightfully prior to making investments. The Railway bubble was followed by the Dot-com bubble, the housing bubbles (Basco, 2014) and the financial crisis of 2008.

The Dot-com bubble (1995-2000) occurred because companies deliberately operated losses to provide services as cheap as possible to increase their market share (Chang et al., 2016). Around this time there was an increase in articles regarding business models that had rarely been discussed or studied in the mainstream or academic press (Hawkins, 2004). This increase of business model articles resulted in a desire to grow market shares by many companies during this period of time (Oliva et al., 2003). In the end investors lost confidence in internet companies due to their share prices increasing while profits did not increase. The projected idea of increasing market share and make profits later failed to materialize and many of these firms ended up making great losses due to their market share growth strategies (Wheale & Amin, 2003).

2. Literature review

2.1 Asset market

The asset market is the entire set of markets in which participants are able to buy and sell real and financial assets, including stocks, bonds, metals, crypto assets and money. On asset markets both information traders and noise traders are able to participate. The difference between the two is that information traders use a proper Bayesian learning rule to estimate future returns while noise traders commit errors as they use non-Bayesian rules (Shefrin & Statman, 1994). Bayesian inference is a method used to update the probabilities of hypothesis when more information becomes available. Meaning that noise traders trade based on incomplete or inaccurate data and it is believed they often make trades based on hypes or rumors, rather than on fundamental analysis. In a market entirely composed of information traders, which excludes noise traders, price efficiency and CAPM hold (Shefrin & Statman, 1994). On a market that includes noise traders, the actions of noise traders are manifested in many ways, which leads to abnormal returns to particular securities. These abnormal returns as a result of noise traders can be seen in the GameStop short squeeze. When the GameStop stock trading was halted shares of GME resources, a tiny mining company located in western Australia, jumped 73% in two days. This can be seen as an example of noise traders trading based on incomplete or inaccurate data. The noise traders considered in this study are the short squeezers, which are formally defined in subsection 2.2.2 “*Short squeeze*”.

2.2 Asset bubbles

An asset “bubble” is defined as a period in which speculative investment leads to an overvaluation of securities within a particular sector (Siegel, 2003). An asset bubble may “burst” when the overvaluation of securities is realized, or rational traders no longer expect positive returns from future price movements. When an asset bursts, the valuation of companies and securities involved will descend rapidly to pre-bubble values (Chang et al., 2016). When an asset has been burst it is easier to define the asset as a bubble, since it is clear that the asset was overvalued. However, determining whether a certain price movement is bubble-like is hard to do contemporaneously. If Garber’s (1990) definition is used, which defines an asset a bubble if it bursts and prices decline back to original pre-bubble price levels, the GameStop stock would not be a bubble since price levels are still above pre-bubble price levels. Even though the asset value rose drastically in January without a supported increase in the value of GameStop. Scientifically defining the term “bubble” is a subject of some debate, particularly bubbles which have yet to collapse (O’Hara, 2008). Jarrow (2015) defines bubbles by the use of the asset’s fundamental value and the market price. When the market price exceeds the

asset's fundamental value, the market price displays a bubble. The market price for an asset is unambiguous, but the meaning of an asset's fundamental value is not. The definition of Jarrow (2015) will be used in this research.

2.3 Causes of asset price bubbles

What causes asset price bubbles? Price bubbles can be caused by multiple phenomena. A couple examples are low interest rates, asset demand-pull inflation and supply shortage (*Price Bubble - Definition, Historical Examples, and Causes*, n.d.). Low interest rates increase the demand for credit, since it means the price for borrowing is low. This increase in credit demand is matched by increased credit creation. When it is easier to borrow money cheaply, investing in assets is more likely to occur. Also when interest rates are low investors are unable to receive a good return on their savings, so they are more likely to move their money into higher-yield assets. This increase on demand of higher-yield assets results in an increase of asset prices. The second cause is the asset demand-pull inflation, which occurs when the demand for an asset exceeds the available supply of that particular asset. Since demand exceeds supply, the asset price increases. The third cause is the supply shortage, when there is a shortage of a particular asset's supply and the demand outweighs the supply. Similar to the demand-pull, when the demand exceeds supply, the asset price increases. An example of a shortage of supply could be when investors choose to hold their assets, rather than trading them, this lowers the supply of assets. Since the demand exceeds supply, investors will have to bid against one another to buy the assets from the investors which are holding. An example of a shortage of supply is the Volkswagen short squeeze. In the Volkswagen short squeeze the float, which is the amount of shares that are being traded rather than being held, was lower than the amount of stocks shorted. Investors who shorted Volkswagen need to buy the security to be able to close their short positions. This shortage in supply resulted in a large price increase, due to investors having to bid against one another to buy the security so that they could close their short position. According to Hong et al., (2006) a bubble arises as price outweighs optimists' beliefs and investors anticipate the option to resell to those with even higher valuations. Investors pay prices that exceed their own valuation, due to the belief that they will find a buyer willing to pay even more (Scheinkman & Xiong, 2003), this reasoning is called the greater fool theory. Another reason for the bubble to arise is that when prices have gone up, the price will only reflect the beliefs of optimistic investors. The pessimistic investors will sit out, since they believe the price of the asset exceeds the fundamental value (Chen et al., 2002).

2.4 Short selling

A short sale is the sale of a stock that one does not own already, but has borrowed from a brokerage house, institutional investor, or another broker-dealer (Dechow et al., 2001). The short seller sells the borrowed stock and closes the position by later buying back the stock to give back the borrowed stock. The payoff for the short seller is the initial price of selling the stock minus the price of buying back the stock to give back the borrowed stock. The maximum profit is the initial price of selling the stock when the stock can be bought back at a price of zero. The potential loss is unlimited since the buyback price of the stock is unlimited. Compared to a put option, the risk is higher since you are not obligated to use a put option (see figure 5), meaning there is a maximum on the loss made.

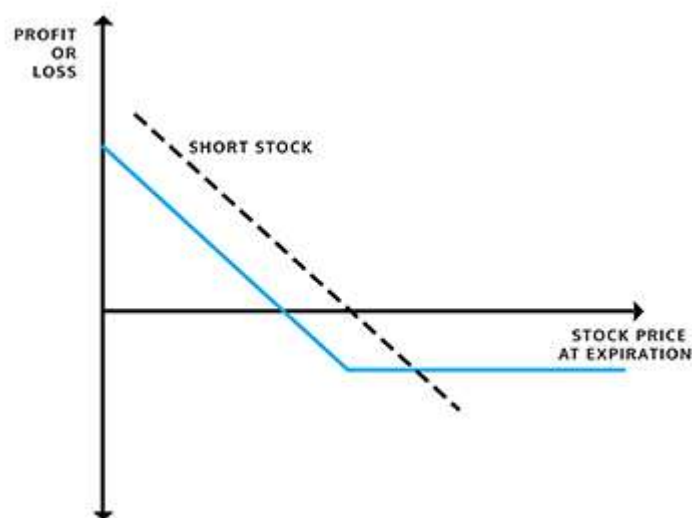


Figure 5. Short Sale (black) & Put Option (blue) profit

As explained by Jarrow (1992), the market manipulation, corners and short squeezes discussed were characterized by extraordinary price increase followed by dramatic collapses, called bubbles. What these bubbles had in common was that they were orchestrated by one individual or a group of individuals acting in concert. Jarrow (1992) shows how a “large trader”, one whose trades change prices, can manipulate the market into a market corner followed by a short squeeze, to attempt to generate profit. Cornering the market is a principle in which someone obtains sufficient control of a particular asset, for example a stock, in an attempt to manipulate the market price. The large trader's trades influence the price due to his size or because other traders believe that the large trader is

informed. Together the large number of non-institutional traders of WSB were able to obtain sufficient control to corner the market, manipulate the market price and initiate a short squeeze. For this reason the combined pool of members of the WSB community will be considered the large trader for the GameStop short squeeze.

When taking in a short position an investor can either choose to pay a so-called fee for a term loan in which the lender of the borrowed shares cannot demand back the shares at any given time or simply borrow the shares and pay back on demand of the lender. In case of the fee for a term loan they settle a time term in which the specified repayment schedule is determined. Even though the risk of paying back when the lender wishes so can be avoided by paying an additional fee, most short-sellers seem to prefer the risk of a squeeze over the cost of a term loan (Dechow et al., 2001).

2.5 Short squeeze

A short squeeze occurs when stocks are purchased by short sellers to close their positions. This closing of positions in turn put pressure on other short sellers to close their positions as well. A short squeeze can arise in many ways, for example in the case of borrowing shares without a term loan the stock lending loan must be repaid on demand and short-sellers are exposed to the risk of being “squeezed” (Dechow et al., 2001). This occurs when the lender of the borrowed shares wants to sell the stock. If the short seller cannot find an alternative stock lender, he must buy back stocks from the market to close his position by paying back the stock that he borrowed. For more liquid securities with large market-capitalization a short squeeze is less likely since finding an alternative stock lender is easier when the initial lender demands the borrowed stock back. However this seems to not always be the case as can be seen in the Volkswagen short squeeze. Even though the risk seemed low because of the firm’s large size and high liquidity (Elfakhani, 2000) there was less stock in free float than was shorted, leading to a “perfect” squeeze (Godfrey, 2016).

Another possibility that can cause short sellers to close their position are margin calls. A short sell requires margin because the practice involves selling stock that is borrowed and not owned. Maintenance margin requirement rules for short sales add a protective measure that further improves the likelihood that the borrowed share will be returned. In the context of the New York Stock Exchange, on which the GameStop stock is traded, the maintenance requirements for short sales are 100% of the current market value of the short sale, along with a percentage of the total market value in the margin account of roughly 30%. The initial margin of the short sale is 150% of the value. So for example if a short sale is initiated over 5,000 shares of at a price of \$100 the short seller is required to make a deposit of \$500,000 into the margin account. Besides the initial deposit an additional margin deposit is required of 50% of the margin amount, which is \$250,000. So For a short sale of 5,000

shares of at a price of \$100 the short seller is required to deposit \$750,000 in his margin account. If the margin requirements exceed the margin of the short seller a margin call is issued meaning that either extra funds must be deposited, or the short position must be closed by either a part or fully. In our example if the stock price would increase to \$120 the market value of the short sale would be \$600,000 and the maintenance margin would be \$180,000, meaning a margin call of \$30,000 would be issued since the market value plus the additional 30% is required.

2.6 Institutional vs. non- institutional investors

The GameStop short squeeze was not initiated by a classical example of a “large trader”. It was triggered by non-institutional investors from an internet forum, which did not know each other in person. The difference between a non-institutional investor and an institutional investor, is that a non-institutional investor is an individual person, whereas an institutional investor is for example a bank, pension

fund, mutual fund company, insurance company or any other large institution. Non-institutional investors buy and sell debt, equity and other investments through brokers, banks, and so on (Institutional vs. Retail Investors). These investors are not investing on other people’s behalf and are driven by personal goals. By definition, the SEC (Securities and Exchange Commission) considers retail investors unsophisticated investors, who are afforded certain protections and barred from making certain risky, complex investments (Institutional vs. Retail Investors). This protection from making risky investments can be seen in the halting of buying GameStop stocks by brokerages on the 28th of January.

3. Research Design

Compared to earlier examples of short squeezes, a short squeeze triggered by an online community of non-institutional investors is a new phenomenon. This leaves the question whether there is a difference, and if so what, in a short squeeze initiated by a group of non-institutional investors or an institutional investor, such as Porsche on the Volkswagen short squeeze (Allen et al., 2017) or Martin Shkreli on the KaloBios short squeeze, and a new type of large trader.

One of the differences one could expect, is a difference in trading volume. A short squeeze initiated by a single institution has one goal in mind regarding the investment. If that same investment budget were to be split over thousands of non-institutional investors, an equal number of opinions and goals is to be expected. Investors have different goals, expectations and investment strategies and will

sell and buy at different price levels. Meaning the short squeeze being initiated by the new large trader consisting of a group of non-institutional investors will lead to a higher trading volume.

The dummy variable shows the effect of the new type of large trader on the volume. The price change is used as an explanatory variable due to the price-volume relationship (Brailsford, 1999; Karpoff, 1987). The bid-ask spread is included by taking the difference of the bid price and the ask price, which is expected to affect the volume, since the bid-ask spread, price volatility and the volume are jointly determined (Wang & Yau, 2000). Also, studies show that there is a positive correlation between price volatility and volume (Gallant et al., 1992; Gul & Javed, 2011). To control for market sentiment, index price and trading volume of the S&P 500 is included as a control variable. Also, market interest is included to control for fluctuations in demand for stocks as a result of changing interest rates. The market interest rate is the prevailing interest rate offered on cash deposits (Rashid, 2018). As a proxy for the market interest rate, a 3 month US dollar deposit is used.

H1: The new large trader has a positive effect on the trading volume for the GameStop short squeeze.

H1: $Volume_{it} = Dummy_{it} + \Delta Price_{it} + BidAskSpread_{it} + PriceVolatility_{it} + interest_{it} + controll\ variables + \epsilon_{it}$

The trading volume will be observed during a time period of 45 trading days. For this time period, a 15 trading days prior and 30 trading days post price peak horizon is used. Trading volume is the amount of stocks which are traded.

Also, one could expect that trading done by one very large trader would be more “lumpy” than for a thousand investors. The large institutional investor will buy at a certain point, whilst the thousand investors have different opinions on the price level for which they are willing to buy. This might lead to a high peak in the trading volume on the day of entrée from the institutional investor, whereas the trading volume would be more spread out with a higher number of investors. Since an institutional investor would buy a relative large amount of stock in one purchase for investment purposes, this is expected to result in a peak of trading volume. With the large group of different traders in the GameStop short squeeze this effect is expected to be less.

H2: The trading volume is less volatile for the GameStop short squeeze in comparison to other short squeezes.

This is tested mathematically by calculating the volatility of the volume for all three short squeezes. By calculating the volatility, it is possible to see which of the three short squeezes is the least volatile and thus has the least lumpy trade. The volatility is calculated over three time periods. The first time period consists of 5 weeks: 1 week prior to the price peak and 4 weeks post. The second time period consists of 5 weeks: 4 weeks prior to the price peak and 1 week post. The third time period consists of 8 weeks: 4 weeks prior to the price peak and 4 weeks post.

As stated in H1, a positive effect of the dummy on trading volume is expected. Due to the positive correlation between price volatility and volume (Gallant et al., 1992; Gul & Javed, 2011), a positive effect of the dummy on the price volatility is also expected. For the price volatility, the 10 days historical price volatility is taken out of the Refinitiv Eikon database. This is calculated as followed: “the 10 day price volatility equals the annualized standard deviation of the relative price change for the 10 most recent trading days closing price, expressed as a percentage”.

The dummy variable shows the effect of the new type of large trader on price volatility. Volume is used as an explanatory variable due to the positive correlation between price volatility and volume (Gallant et al., 1992; Gul & Javed, 2011). Bid-ask spread is included as bid-ask spread and price volatility are jointly determined (Wang & Yau, 2000). Again, control variables are included to control for market sentiment and market interest rate. As a proxy for the market interest rate, 3 month US dollar deposit is used.

H3: The new large trader has a positive effect on the price volatility for the GameStop short squeeze.

H3: PriceVolatility_{it} = Dummy_{it} + Volume_{it} + BidAskSpread_{it} + Market_{it} + controll variables + ε_{it}

Price volatility is observed during a time period of 12 weeks. Time period ranges from 4 weeks prior to the price peak to 8 weeks post price peak.

Besides the causal relationship between trading volume and price volatility, a causal relationship exists between the trading volume and the returns of an asset (Balcilar et al., 2017). Since trading volume is expected to be higher for the GME short squeeze compared to the other examples, the return of an asset is expected to be higher.

The dummy variable shows the effect of the new type of large trader on stock returns. Dividends are used as an explanatory variable, since the stocks dividends help explain the intrinsic value of a stock. The bid-ask spread is included as it is jointly determined with volatility and volume (Wang & Yau, 2000). Bid-ask spread also affects asset pricing (Amihud & Mendelson, 1986). Volume is used as an explanatory variable due to the price-volume relationship (Brailsford, 1999; Karpoff, 1987). The lagged volume is used as an explanatory variable to include momentum, as past trading volume predicts both the magnitude and persistence of price momentum (Lee & Swaminathan, 2000). Again, control variables are included to control for market sentiment and market interest rate. As a proxy for the market interest rate, 3 month US dollar deposit is used.

H4: The new large trader has a positive effect on the stock return for the GameStop short squeeze.

H4: StockReturn_{it} = Dummy_{it} + Dividends_{it} + BidAskSpread_{it} + Volume_{it} + Volume_{i(t-1)} + interest_{it} + controll variables + ε_{it}

The stock return is observed during a time period of 8 weeks. For this time period a 4 weeks prior and 4 weeks post price peak horizon is used. Stock return is the percentage of increase in stocks value. Return variable will be made out of the price change, by looking at the price change as if there was invested 4 weeks prior to the price peak. Return is calculated excluding the dividend payments, dividends are included as an explanatory variable.

Price changes supported with weak volume tend to reverse (Stickel, 1994). Since the volume is expected to be higher for the GameStop short squeeze, it is expected that the price changes reversal is lower in comparison to the other short squeezes. This is observed over the periods of 2 weeks, 4 weeks, 6 weeks and 8 weeks post price peak.

H5: The reversal in price changes is lower for the GameStop short squeeze in comparison to other short squeezes.

*H5: $\Delta Price_{it} = Dummy_{it} + Dividends_{it} + BidAskSpread_{it} + Volume_{it} + interest_{it} +$
controll variables $+ \epsilon_{it}$*

This hypothesis is tested in the same way as hypothesis 4, but for a different time period. The reversal in price changes are observed on a time period of 8 weeks post price peak and are observed in a percentages of the price peak.

3.1 Control Variables

The control variables used in this research are the index price and trading volume of the S&P 500. These control for general market sentiment during the observed periods of time. The S&P 500, NASDAQ and the Dow Jones Industrial Average were considered for this research. Out of these three, the S&P 500 was chosen, as it is the most diversified with the largest number of constituents, which makes it best suited as a proxy for the market sentiment. The market sentiment is the overall attitude of investors in the financial market, for this reason it is also called “investor sentiment”. This sentiment includes the psychology of investors and whether a market might be bullish (rising prices) or bearish (falling prices). Besides the index, the interest rate offered on cash deposits is included. Interest rates influence the demand for assets. When interest rates on cash deposits are high, saving is more beneficial. When interest rates on cash deposits are low, saving is less beneficial and other assets are more appealing.

3.2 Limitations

This study uses a limited number of observations, as big data on short squeezes of this caliber is limited. The short squeezes used in this study are the Volkswagen and KaloBios short squeezes.

These short squeezes are chosen due to their high price increase. During their short squeezes prices for Volkswagen increased roughly 230% and prices for KaloBios increased roughly 2060%. Other short squeezes considered are: Alibaba Group Holding Limited, which climbed roughly 65% during the short squeeze, Tesla in mid-2020, which climbed roughly 50%, Piggly Wiggly, which took place in the 20's, the Northern Pacific short squeeze, which occurred in 1901, and the short squeeze on bonds by Phillip Falcone, which occurred in 2012. However, since these short squeezes either did not have the same price impact as the Volkswagen, KaloBios and GameStop short squeeze, were over one hundred years ago or were not on stocks but on bonds, this data was not included in this study. Due to the small sample size in this study, the results will be suggestive rather than robust. However, even though the results may be suggestive it is still interesting to study, since short squeezes of this caliber are such a rare phenomenon. The results of this study might lead to insights on which new studies can be done.

4. Data

The primary sample of the data consist of the following organizations on which a short-squeeze has occurred, being GameStop, Volkswagen and KaloBios. The Volkswagen and KaloBios short squeeze were both initiated on the stock market by large institutions. The data will be consisting of 3 time periods of 12 weeks taken for these three stocks, 4 weeks prior to the short squeeze's price peak and 8 weeks post peak. For Volkswagen, which peaked October 28, 2008, the data ranges from September 30, 2008 to December 23, 2008. For KaloBios, which peaked November 23, 2015, the data ranges from October 26, 2015 to January 18, 2016. For GME, which peaked on January 27, 2021, the data ranges from December 30, 2020 to March 24, 2021. Daily data will be used and the data is collected from the Refinitiv Eikon database, consisting of historical time series data. Since data regarding the S&P500 volume is missing in the Eikon database for the Volkswagen short squeeze time period, the data regarding the S&P500 trading volume is collected from Stooq. Due to the size of the trading volume, the logarithm will be used in the research. The main variable used in this study is the dummy variable which explains whether the short squeeze was being initiated by an institutional investor or non-institutional investors. As for the GameStop short squeeze this dummy will hold a value of 1 and for the Volkswagen and KaloBios short squeeze this variable will hold a value of 0. The research consist of panel data across time, due to the data consisting of the same three subjects in different time periods. For this reason a panel data regression model will be used. A fixed-effects model will be used to include the type of large trader dummy. In the data companies are numbered 1, 2 and 3 which are Volkswagen, KaloBios and GameStop respectively. The following three tables show a summary of the data sample for the three short squeezes their respective time periods.

Table 1. Summary Volkswagen Variables from Data Sample. Time period September 30, 2008 to December 23, 2008.

Variable	Mean	Std.Dev	25ThPerc.	Median	75thPerc.	Num.Obs
Price	337.63	99.73	284.06	304.92	385.87	61
Volume	43.21	106.41	1.80	5.80	38.20	61
DividendYield	0.56	0.12	0.46	0.59	0.63	61
Dividend	1.79	0,00	1.79	1.79	1.79	61
AskPrice	337.92	99.48	284.35	305.23	386.26	61
BidPrice	337.25	99.20	284.06	304.61	385.49	61
Price						
volatility	1.93	2.03	0.56	0.98	1.77	61
SP500Price	918.30	80.04	871.63	899.24	952.77	61
SP500Volume	9.53	0.09	9.49	9.53	9.58	60
InterestRate	3.75	1.25	2.78	3.63	4.45	61
BidAsk	0.67	0.69	0.42	0.59	0.69	61

Note: InterestRate= 3 Month US Dollar Deposit rate,

Price, volume, dividend, ask & bid prices and price volatility are from company Volkswagen.

Table 2. Summary KaloBios Variables from Data Sample. Time period. October 26, 2015 to January 18, 2016.

Variable	Mean	Std.Dev	25ThPerc.	Median	75thPerc.	Num.Obs
Price	79.61	56.91	8.88	108.03	113.79	61
Volume	443.36	811.46	13.30	70.00	274.80	41
DividendYield	0,00	0,00	0,00	0,00	0,00	61
Dividend	0,00	0,00	0,00	0,00	0,00	61
AskPrice	70.44	66.10	8.61	48.38	137.83	37
BidPrice	70.07	65.88	8.47	46.71	137.65	58
Price						
volatility	3.35	3.69	0.52	0.80	6.20	61
SP500Price	2044.46	58.83	2023.04	2063.36	2083.58	61
SP500Volume	9.33	0.12	9.31	9.35	9.38	57
InterestRate	0.79	0.13	0.76	0.82	0.88	61
BidAsk	0.01	0.01	0.01	0.01	0.02	57

Note: InterestRate= 3 Month US Dollar Deposit rate,

Price, volume, dividend, ask & bid prices and price volatility are from company KaloBios.

Table 3. Summary GameStop Variables from Data Sample. Time period December 30, 2020 to March 24, 2021

Variable	Mean	Std.Dev	25ThPerc.	Median	75thPerc.	Num.Obs
Price	87.55	72.91	32.89	53.03	153.09	61
Volume	45839.28	46250.94	14429.10	29523.10	62427.30	58
DividendYield	0	0	0	0	0	61
Dividend	0	0	0	0	0	61
AskPrice	90.68	73.53	33.56	58.35	162.75	58
BidPrice	90.26	73.20	33.54	58.23	157.63	58
Price volatility	3.46	2.45	1.68	2.61	3.86	61
SP500Price	3851.95	71.18	3799.61	3853.07	3913.10	61
SP500Volume	9.40	0.08	9.36	9.39	9.44	58
InterestRate	0.29	0.00	0.29	0.29	0.29	61
BidAsk	0.42	1.69	0.01	0.03	0.22	58

Note: InterestRate= 3 Month US Dollar Deposit rate,

Price, volume, dividend, ask & bid prices and price volatility are from company GameStop.

5. Results

The first hypothesis in this study researches the effect of the new type of traders in the GameStop short squeeze on the trading volume.

H1: The new large trader has a positive effect on the trading volume for the GameStop short squeeze.

H1: $Volume_{it} = Dummy_{it} + Price_{it} + BidAskSpread_{it} + PriceVolatility_{it} + interest_{it} + controll\ variables + \epsilon_{it}$

For the regression of the panel data, a random effects model has been used. This was due to the results of the Hausman and Breusch-Pagan test, which both favored the random effects model. The results are shown in “table 4”. The significance of control and explanatory variables is lower than expected. The price-volume relationship (Brailsford, 1999; Karpoff, 1987) shows no significant effect. Neither do the bid-ask spread and the price volatility, which are supposed to be jointly determined with volume (Wang & Yau, 2000). This might be due to the low number of observations or due to the data gaps in the trading volume for KaloBios stock. However, the dummy variable representing the new type of trader does show the expected positive effect. Which means the hypothesis “*The new large trader has a positive effect on the trading volume for the GameStop short squeeze*” is accepted. The low R-

squared suggests that a low proportion of the variance of the dependent variable is explained by the independent variables, suggesting that independent variables are missing.

Table 4. Results RE model Hypothesis 1

Volume		Coef.	z
Dummy		60054.1*	(2.39)
Price		-31.96	(-0.94)
BidAsk		665.4	(0.30)
Price			
volatility		1534.7	(1.32)
SP500Price		-5.757	(-0.54)
SP500Volume		40056.3	(1.13)
_cons		-368179.5	(-1.08)
N	112		
R2	0.4233		

t statistics in parentheses. *p<0.05 ; **p<0.01 ;

***p<0.001

For the second hypothesis, the volatility of the volume is calculated to see whether the trading volume of the GameStop short squeeze was more “smooth”.

H2: The trading volume is less volatile for the GameStop short squeeze in comparison to other short squeezes.

The volatility is calculated over two time periods of 5 weeks, with 4 weeks prior to the price peak to 1 week post and 1 week prior to the price peak to 4 weeks post. For the Volkswagen short squeeze, this resulted in the periods: September 30, 2008 to November 4, 2008 and October 21, 2008 to November 25, 2008. For the KaloBios short squeeze, this resulted in the periods: October 26, 2015 to November 30, 2015 and November 16, 2015 to December 21, 2015. For the GameStop short squeeze this resulted in the periods: December 30, 2020 to February 3, 2021 and January 20, 2021 to February 24, 2021.

There are several ways to measure volatility. Typically historical volatility is used. Historical volatility is a measure of the dispersion over a given period of time. Dispersion describes the size of the distribution of values expected for a particular variable and can be measured by several different statistics, such as range, variance, and standard deviation (*Investopedia*, 2021). For this hypothesis, the

volatility of the volume is calculated by the use of coefficient of variation, also known as the relative standard deviation, over the 5 week time periods. The coefficient of variation is defined as the ratio of the standard deviation to the mean (Investopedia, 2021). For the first time period, the coefficient of variations are 152.3936, 149.5838 and 48.9816 for Volkswagen, KaloBios and GameStop respectively. This suggests that pre-price peak the trading volume of GameStop was less volatile and thus less lumpy than the other two short squeezes. For the second time period the coefficient of variations are 245.1047, 126.6735 and 55.6924 for Volkswagen, KaloBios and GameStop respectively. This suggests that post-price peak the trading volume of GameStop was also less volatile and thus less lumpy than the other two short squeezes. The volatility of the trading volume was also calculated over a 8 weeks' time period which ranged from 4 weeks prior to 4 weeks post price peak. The coefficient of variations are 197.9056, 176.4298 and 55.2876 for Volkswagen, KaloBios and GameStop respectively. The results of these calculations show that the overall volatility in trading volume was the lowest for GameStop over all three time periods. Due to the results the hypothesis “*The trading volume is less volatile for the GameStop short squeeze in comparison to other short squeezes.*” is accepted. Meaning the trading volume of the GameStop short squeeze was more “smooth” than the other short squeezes.

The third hypothesis in this study researches the effect of the new type of large trader in the GameStop short squeeze on the price volatility.

H3: The new large trader has a positive effect on the price volatility for the GameStop short squeeze.

H3: PriceVolatility_{it} = Dummy_{it} + Volume_{it} + BidAskSpread_{it} + Marketinterest_{it} + controll variables + ε_{it}

For the regression of the panel data a random effects model is used. This is due to the results of the Hausman and Breusch-Pagan test, which both favor the random effects model. The results are shown in “table 5” and are not in line with the expectations. The “Dummy” variable, which represents the new type of traders, shows a negative effect on the price volatility of the GameStop stock. A positive effect was expected due to the expected differences in opinions, which would lead to different price expectations and a higher price volatility. The results conclude a negative effect of the new type of trader on the price volatility. The hypothesis “*The new large trader has a positive effect on the price volatility for the GameStop short squeeze*” is therefore rejected. There are multiple possible explanations for the new type of traders negative effect on the price volatility. It might be that the difference in price expectations is in fact much lower. If there is a lower difference in the price expectations, the price volatility is also expected to be lower. Another explanation might be that price volatility is lower since the members of WSB kept holding the GameStop asset, which resulted in a lower price volatility. Unlike the first regression, the control and explanatory variables are significant.

The bid-ask spread, price volatility and volume, which are supposed to be jointly determined (Wang & Yau, 2000), show significance in the regression. The bid-ask spread shows high significance and the volume nearly passed the p-test with an α of 0.052. The low R-squared suggests that a low proportion of the variance of the dependent variable is explained by the independent variables, suggesting that independent variables are missing.

Table 5. Results RE model Hypothesis 3

PriceVolatility		Coef.	z
Dummy		-3.501*	(-2.17)
Volume		0.0000138	(1.94)
BidAsk		0.585***	(3.32)
InterestRate		0.345	(1.40)
SP500Price		0.00158*	(2.09)
SP500Volume		-8.591***	(-3.50)
_cons		80.70***	(3.45)
N	155		
R2	0.2496		

t statistics in parentheses. *p<0.05 ; **p<0.01 ; ***p<0.001

The fourth hypothesis researches the effect of the new type of large trader on the stock return.

H4: The new large trader has a positive effect on the stock return for the GameStop short squeeze.

$$H4: StockReturn_{it} = Dummy_{it} + Dividends_{it} + BidAskSpread_{it} + Volume_{it} + Volume_{i(t-1)} + PriceVolatility_{it} + Marketinterest_{it} + controll\ variables + \epsilon_{it}$$

For the regression of the panel data, a random effects model is used. This is due to the results of the Hausman and Breusch-Pagan test, which both favored the random effects model. The results are shown in “table 6”. The “Dummy” variable, which represents the new type of traders, shows a negative effect on the stock return of the GameStop stock, instead of the expected positive effect. This might be due to KaloBios large stock return of 2000% from 30 days prior to the price peak or due to the GameStop stock showing a peak and dip, whereas the KaloBios stock peaked and did not dip as hard. The GameStop stock had a peak return of roughly +1735%, but ended at +380% over the studied time period. The KaloBios stock had a peak return of roughly +2060% and ended at +1150% over the

studied time period. The negative effect might be due to the expected effect of trading volume on the stock return not showing in the regression. Volume is not significantly different from zero, so has no effect in this regression. The expectation was that due to the expected higher volume for GameStock the stock return would be higher, but this effect was not proven to be true and the hypothesis “*The new large trader has a positive effect on the stock return for the GameStop short squeeze*” is not accepted.

Table 6. Results RE model Hypothesis 4

StockReturn		Coef.	z
Dummy		-12.46*	(-2.57)
DividendYield		-3320,00	(-0.60)
BidAsk		0.335	(0.96)
Volume		-0.00000362	(-0.19)
Volume(t-1)		0.0000228	(1.15)
Price volatility		0.675***	(4.02)
InterestRate		0.353	(0.55)
SP500Price		0.00406	(1.57)
SP500Volume		16.48*	(2.38)
_cons		-158.9*	(-2.42)
N	109		
R2	0.4065		

t statistics in parentheses. *p<0.05 ; **p<0.01 ;

***p<0.001

The fifth hypothesis in this study researches the effect of the new type of large trader on the reversal in price changes.

H5: The reversal in price changes is lower for the GameStop short squeeze in comparison to other short squeezes.

$$H5: \Delta Price_{it} = Dummy_{it} + Dividends_{it} + BidAskSpread_{it} + Volume_{it} + PriceVolatility_{it} + Marketinterest_{it} + controll\ variables + \epsilon_{it}$$

For the regression of the panel data a random effects model is used. This is due to the results of the Hausman and Breusch-Pagan test, which both favor the random effects model. The results are shown in “table 7”. The results of hypothesis 5 are in line with the expectations and hypothesis “*The reversal in price changes is lower for the GameStop short squeeze in comparison to other short squeezes*” is

rejected. Results of hypothesis are not significance, meaning that the dummy had no effect on the price reversal. Overall, only dividend yield showed a significant effect on the price reversal. Besides the dummy having no effect on the price reversal the explanatory and control variables showed no effect, suggesting that explanatory variables were missing.

Table 7. Results RE model Hypothesis 5

PriceReversal	
	Coef. z
Dummy	-0.189 (-0.49)
DividendYield	-1.029** (-3.06)
BidAsk	0.0123 (0.91)
Volume	0.000000875 (0.89)
Price volatility	-0.00403 (-0.52)
InterestRate	-0.00000252 (-0.00)
SP500Price	-0.000113 (-0.54)
SP500Volume	0.262 (1.14)
_cons	-1.452 (-0.61)
N	97
R2	0.4613

t statistics in parentheses. *p<0.05 ; **p<0.01 ;

***p<0.001

6. Conclusion.

This empirical study aims to understand to what extent the market behavior of the gameStop short squeeze differs compared to other short squeezes. This is done by using a dummy variable as a proxy for the new type of large trader in random effects regressions and a mathematical calculations regarding how smooth the trading volume was. For this study panel data, ranging from 2008 to 2021, of three companies was extracted from the Refinitiv Eikon database.

Although the significance of the results was low, this is in line with the expectations and limitations of this study. The regressions shows significant results for hypothesis 1, 3 and 4. Hypothesis 1 is accepted and although results from the regressions for hypothesis 3 and 4 were significant, they are not in line with the expected results. Hypothesis 3 and 4 proven to have negative effects rather than the expected positive effects and thus were rejected. As for the question to what extent the market behavior of the GameStop short squeeze differs from the other short squeezes results

suggest the new type of large trader to have a positive effect on the trading volume, a negative effect on the price volatility, a negative effect on the stock return and no effect on the price reversal. Also by the use of mathematical calculations it is proven that the trading volume of the GameStop short squeeze was more “smooth” than the other short squeezes.

The R-squared was below 0.50 for all four regressions. This low R-squared suggests that explanatory variables were missing in the regressions. Control variables show a low significance in the random effects regressions. This might be due to the low amount of observations. Also it might be that, due to the short squeeze, the explanatory and control variables do not react in the way previous research has proven them to react, since a short squeeze is an anomaly. However, the control variables still helped with the explanatory power of the regressions, with at least one showing significance in all regressions.

Future research recommendations

There is still a large amount of future research that needs to be performed regarding the effects of online communities as a type of large trader. As for my recommendations for future research, there are three points I would like to bring to light. Firstly, more research is needed into the effects of online communities on the stock market. WallStreetBets will most likely stay active on the stock market, and with the current growth in members they are not to be overlooked. Secondly, a more extensive study regarding the effects of the GameStop short squeeze might be very interesting. The low R-squared in the regressions suggest missing variables, which could be included in a more extensive study. Besides the added variables, data could be collected on a shorter time interval. In this study, data is used on a daily interval. A more extensive study using hourly data could gain more insight in the effect of the new type of large trader on the short squeeze. Thirdly, the negative effect of the new large trader on the price volatility and stock return could be studied. The effect on price volatility was expected to be positive due to the expected positive effect on the volume. Though the results show a positive effect on volume, price volatility is negatively affected. Performing a more extensive study on this effect might lead to new information regarding the correlation between volatility and volume.

References

- Allen, F., Haas, M., Nowak, E., & Tenuglov, A. (2017). Market Efficiency and Limits to Arbitrage: Evidence from the Biggest Short Squeeze in History. *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.2977019>
- Amihud, Y., & Mendelson, H. (1986). Asset pricing and the bid-ask spread. *Journal of Financial Economics*, 17(2), 223–249. [https://doi.org/10.1016/0304-405X\(86\)90065-6](https://doi.org/10.1016/0304-405X(86)90065-6)
- Balcilar, M., Bouri, E., Gupta, R., & Roubaud, D. (2017). Can volume predict Bitcoin returns and volatility? A quantiles-based approach. *Economic Modelling*, 64, 74–81. <https://doi.org/10.1016/j.econmod.2017.03.019>
- Basco, S. (2014). Globalization and financial development: A model of the Dot-Com and the Housing Bubbles. *Journal of International Economics*, 92(1), 78–94. <https://doi.org/10.1016/j.jinteco.2013.10.008>
- Bohl, M. T., & Henke, H. (2003). Trading volume and stock market volatility: The Polish case. *International Review of Financial Analysis*, 12(5), 513–525. [https://doi.org/10.1016/S1057-5219\(03\)00066-8](https://doi.org/10.1016/S1057-5219(03)00066-8)
- Brailsford, T. (1999). *THE EMPIRICAL RELATIONSHIP BETWEEN TRADING VOLUME , RETURNS AND VOLATILITY Non-technical Executive Summary*.
- Brunnermeier, M. K., & Nagel, S. (2005). Hedge Funds and the Technology Bubble. *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.423940>
- BU Professor sheds light on “Wall Street Bets” group from Reddit*. (n.d.). WBNG. Retrieved May 8, 2021, from <https://wbng.com/2021/01/31/bu-professor-sheds-light-on-wall-street-bets-group-from-reddit/>
- Chang, V., Newman, R., Walters, R. J., & Wills, G. B. (2016). Review of economic bubbles. *International Journal of Information Management*, 36(4), 497–506. <https://doi.org/10.1016/j.ijinfomgt.2016.02.007>
- Chen, J., Hong, H., & Stein, J. (2002). Breadth of Ownership and Stock Returns. *Journal of Financial Economics*, 66(November-December).
- Coefficient of Variation (CV)*. (2021, April 16). Investopedia. <https://www.investopedia.com/terms/c/coefficientofvariation.asp>
- Cuthbertson, A. (2021, January 29). *Dogecoin: GameStop frenzy takes crypto market over \$1 trillion as Reddit stock investors switch to bitcoin rival* . The Independent. <https://www.independent.co.uk/life-style/gadgets-and-tech/dogecoin-price-stock-buy-gamestop-reddit-bitcoin-b1794695.html>
- Davidson, J. (2018, October 25). *Inside Reddit’s Wall Street Bets Investing forum | Money*. Money. <https://money.com/wall-street-bets/>
- Dechow, P. M., Hutton, A. P., Meulbroek, L., & Sloan, R. G. (2001). Short-sellers, fundamental analysis, and stock returns. *Journal of Financial Economics*, 61(1), 77–106. [https://doi.org/10.1016/S0304-405X\(01\)00056-3](https://doi.org/10.1016/S0304-405X(01)00056-3)
- Dispersion Definition*. (2021). Investopedia. <https://www.investopedia.com/terms/d/dispersion.asp>
- Donaldson, R. G., & Kamstra, M. (1996). A New Dividend Forecasting Procedure That Rejects Bubbles in Asset

- Prices: The Case of 1929's Stock Crash. *Review of Financial Studies*, 9(2), 333–383.
<https://ideas.repec.org/a/oup/rfinst/v9y1996i2p333-83.html>
- Elfakhani, S. (2000). Short positions, size effect, and the liquidity hypothesis: Implications for stock performance. *Applied Financial Economics*, 10(1), 105–116. <https://doi.org/10.1080/096031000331978>
- Forbes. (2014). #1565 Philip Falcone. <https://www.forbes.com/profile/philip-falcone/?sh=64cd1fa545be>
- Frehen, R. G. P., Goetzmann, W. N., & Geert Rouwenhorst, K. (2013). New evidence on the first financial bubble. *Journal of Financial Economics*, 108(3), 585–607. <https://doi.org/10.1016/j.jfineco.2012.12.008>
- Gallant, A. R., Rossi, P. E., & Tauchen, G. (1992). Stock Prices and Volume. *Review of Financial Studies*, 5(2), 199–242. <https://doi.org/10.1093/rfs/5.2.199>
- Garber, P. M. (1989). Tulipmania. *Journal of Political Economy*, 97(3), 535–560.
<https://doi.org/10.1086/261615>
- Garber, P. M. (1990). Famous First Bubbles. *Journal of Economic Perspectives*, 4(2), 35–54.
<https://doi.org/10.1257/jep.4.2.35>
- GME | GameStop Corp. *Cl A Advanced Charts*. (n.d.). MarketWatch. Retrieved June 10, 2021, from
https://www.marketwatch.com/investing/stock/gme/charts?mod=mw_quote_advanced
- Godfrey, K. R. L. (2016). Detecting the great short squeeze on Volkswagen. *Pacific Basin Finance Journal*, 40, 323–334. <https://doi.org/10.1016/j.pacfin.2016.02.001>
- Greifeld, K., & Lipschultz, B. (2021, January 25). *GameStop Short-Sellers Reload Bets After \$6 Billion Loss*. Bloomberg. <https://www.bloomberg.com/news/articles/2021-01-25/gamestop-short-sellers-reload-bearish-bets-after-6-billion-loss>
- Gul, F., & Javed, T. (2011). Relationship Between Trading Volume And Stock Exchange Performance: A Case From Karachi Stock Exchange. *International Business & Economics Research Journal (IBER)*, 8(8).
<https://doi.org/10.19030/iber.v8i8.3155>
- Hawkins, R. (2004). Looking beyond the dot com bubble: exploring the form and function of business models in the electronic marketplace. In *E-Life after the Dot Com Bust* (pp. 65–81). Physica-Verlag HD.
https://doi.org/10.1007/978-3-662-11659-3_4
- Hong, H., Scheinkman, J., & Xiong, W. (2006). Asset Float and Speculative Bubbles. In *THE JOURNAL OF FINANCE • Vol. LXI* (Issue 3).
- Jarrow, R. A. (1992). Market Manipulation, Bubbles, Corners, and Short Squeezes. *The Journal of Financial and Quantitative Analysis*, 27(3), 311. <https://doi.org/10.2307/2331322>
- Jarrow, R. A. (2015). *Asset Price Bubbles*. <https://doi.org/10.1>
- Jarrow, R. A., Protter, P., & Shimbo, K. (2007). Asset price bubbles in complete markets. In *Applied and Numerical Harmonic Analysis* (Issue 9780817645441, pp. 97–121). Springer International Publishing.

https://doi.org/10.1007/978-0-8176-4545-8_7

Karpoff, J. M. (1987). The Relation Between Price Changes and Trading Volume: A Survey. *The Journal of Financial and Quantitative Analysis*, 22(1), 109. <https://doi.org/10.2307/2330874>

Kharpal, A. (2021, January 28). *Reddit frenzy pumps up Dogecoin, a cryptocurrency started as a joke*. <https://www.cnbc.com/2021/01/29/dogecoin-cryptocurrency-rises-over-400percent-after-reddit-group-talks-it-up.html>

Koers, grafieken, marktkapitalisatie en andere metrics voor Dogecoin (DOGE) | CoinMarketCap. (n.d.). Coinmarketcap. Retrieved June 9, 2021, from <https://coinmarketcap.com/nl/currencies/dogecoin/historical-data/>

Lee, C. M. C., & Swaminathan, B. (2000). Price Momentum and Trading Volume. *The Journal of Finance*, 55(5), 2017–2069. <https://doi.org/10.1111/0022-1082.00280>

McCartney, S., & Arnold, A. J. (2003). The railway mania of 1845-1847: Market irrationality or collusive swindle based on accounting distortions? *Accounting, Auditing & Accountability Journal*, 16(5), 821–852. <https://doi.org/10.1108/09513570310505970>

McGregor, G. (2021, January 29). *Caught in GameStop short squeeze, a different \$GME stock takes a wild ride*. Fortune. <https://fortune.com/2021/01/29/gamestop-stock-gme-resources-short-squeeze/>

O'Hara, M. (2008). Bubbles: Some Perspectives (and Loose Talk) from History. *Review of Financial Studies*, 21(1), 11–17. <https://doi.org/10.1093/rfs/hhn001>

Odlyzko, A. (2011). Collective Hallucinations and Inefficient Markets: The British Railway Mania of the 1840s. *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.1537338>

Ofek, E., & Richardson, M. (2003). DotCom Mania: The Rise and Fall of Internet Stock Prices. *Journal of Finance*, 58(3), 1113–1138. <https://doi.org/10.1111/1540-6261.00560>

Oliva, R., Sterman, J. D., & Giese, M. (2003). Limits to growth in the new economy: Exploring the “get big fast” strategy in e-commerce. *System Dynamics Review*, 19(2), 83–117. <https://doi.org/10.1002/sdr.271>

Pastor, L., & Veronesi, P. (2011). Was There a Nasdaq Bubble in the Late 1990s? *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.557061>

Price Bubble - Definition, Historical Examples, and Causes. (n.d.). Retrieved April 1, 2021, from <https://corporatefinanceinstitute.com/resources/knowledge/economics/price-bubble/>

R-Squared Definition. (2021, March 9). Investopedia. <https://www.investopedia.com/terms/r/r-squared.asp>

r/wallstreetbets subreddit stats. (n.d.). Retrieved May 8, 2021, from <https://subredditstats.com/r/wallstreetbets>

Rappoport, P., & White, E. N. (1993). *WAS THERE A BUBBLE IN THE 1929 STOCK MARKET?* https://www.nber.org/system/files/working_papers/w3612/w3612.pdf

Rashid, A. (2018). Macroeconomic Variables and Stock Market Performance: Testing for Dynamic Linkages

- with Known Structural Break. *Pravaha*, 24(1). <https://doi.org/10.3126/pravaha.v24i1.20220>
- Rockoff, J. D. (2015, December 17). *Martin Shkreli: From Biotech Entrepreneur to Accused Criminal - WSJ*. <https://www.wsj.com/articles/martin-shkreli-from-biotech-entrepreneur-to-accused-criminal-1450389335>
- Sarlin, J. (2021, January 30). *Inside WallStreetBets, the Reddit army that's rocking Wall Street - CNN*. CNN Business. <https://edition.cnn.com/2021/01/29/investing/wallstreetbets-reddit-culture/index.html>
- Scheinkman, J. A., & Xiong, W. (2003). Overconfidence and speculative bubbles. *Journal of Political Economy*, 111(6), 1183–1219. <https://doi.org/10.1086/378531>
- Shefrin, H., & Statman, M. (1994). Behavioral Capital Asset Pricing Theory. *The Journal of Financial and Quantitative Analysis*, 29(3), 323. <https://doi.org/10.2307/2331334>
- Siegel, J. J. (2003). What Is an Asset Price Bubble? An Operational Definition. *European Financial Management*, 9(1), 11–24. <https://doi.org/10.1111/1468-036X.00206>
- Stickel, S. E. (1994). *Evidence That Trading Volume Sustains Stock Price Changes Article in Financial Analysts Journal*. <https://doi.org/10.2469/faj.v50.n6.57>
- Temin, P., & Voth, H. J. (2004). Riding the South Sea bubble. *American Economic Review*, 94(5), 1654–1668. <https://doi.org/10.1257/0002828043052268>
- The Chairman on Twitter: "Has Doge ever been to a dollar?" / Twitter*. (n.d.). Twitter. Retrieved June 9, 2021, from https://twitter.com/WSBChairman/status/1354658870560481285?ref_src=twsrc%5Etfw%7Ctwcamp%5Etweetembed%7Ctwterm%5E1354658870560481285%7Ctwgr%5E%7Ctwcon%5Es1_&ref_url=https%3A%2F%2Fnieuws.btcdirect.eu%2Fdoge-gamestop%2F
- Wang, G. H. K., & Yau, J. (2000). Trading volume, bid–ask spread, and price volatility in futures markets. *Journal of Futures Markets*, 20(10), 943–970. <https://econpapers.repec.org/RePEc:wly:jfutmk:v:20:y:2000:i:10:p:943-970>
- Wheale, P. R., & Amin, L. H. (2003). Bursting the dot.com “Bubble”: A case study in investor behaviour. *Technology Analysis and Strategic Management*, 15(1), 117–136. <https://doi.org/10.1080/0953732032000046097>
- White, E. N. (1990). The Stock Market Boom and Crash of 1929 Revisited. *The Journal of Economic Perspectives*. <https://www.jstor.org/stable/1942891?seq=1>

Appendix

The stata .Do File:

```
import excel "C:\Users\A\Documents\DataMTScriptie.xlsx", sheet("Volkswagen") firstrow clear  
destring, replace
```

```
tsset Date
```

```
univar Price Volume DividendYield Dividend AskPrice BidPrice Volatility SP500Price SP500Volume  
InterestRate BidAsk
```

```
import excel "C:\Users\A\Documents\DataMTScriptie.xlsx", sheet("KaloBios") firstrow clear  
destring, replace
```

```
tsset Date
```

```
univar Price Volume DividendYield Dividend AskPrice BidPrice Volatility SP500Price SP500Volume  
InterestRate BidAsk
```

```
import excel "C:\Users\A\Documents\DataMTScriptie.xlsx", sheet("GME") firstrow clear  
destring, replace
```

```
tsset Date
```

```
univar Price Volume DividendYield Dividend AskPrice BidPrice Volatility SP500Price SP500Volume  
InterestRate BidAsk
```

```
import excel "C:\Users\A\Documents\DataMTScriptie.xlsx", sheet("Data1") firstrow clear  
destring, replace
```

```
* Hypothesis 1
```

```
* Set data as panel data
```

```
global id          Company
```

```
global t          Date
```

```
global ylist      Volume
```

```
global xlist      Dummy Price BidAsk Volatility SP500Price SP500Volume
```

```
xtset $id $t
```

```
quietly xtreg $ylist $xlist, fe
estimates store fixed
quietly xtreg $ylist $xlist, re
estimates store random
hausman fixed random
```

* Prob > chi2 = 0.000 (significant results so used fixed effects)
* Prob > chi2 = 1.000 So random effects should be used

```
quietly xtreg $ylist $xlist, re
xttest0
```

* Chibar value low means using pooled ols model.
* Since Chibar is high for this test, random effects model should be used.

```
eststo: xtreg $ylist $xlist, re
esttab
eststo clear
```

* Hypothesis 3

```
import excel "C:\Users\A\Documents\DataMTScriptie.xlsx", sheet("Data2") firstrow clear
destring, replace
```

* Set data as panel data

```
global id          Company
global t           Date
global ylist       Volatility
global xlist       Dummy Volume BidAsk InterestRate SP500Price SP500Volume
xtset $id $t
```

```
quietly xtreg $ylist $xlist, fe
estimates store fixed
quietly xtreg $ylist $xlist, re
estimates store random
hausman fixed random
```

```
quietly xtreg $ylist $xlist, re
xttest0
```

```
eststo: xtreg $ylist $xlist, re
esttab
eststo clear
```

```
* Hypothesis 4
```

```
import excel "C:\Users\A\Documents\DataMTScriptie.xlsx", sheet("Data3") firstrow clear
destring, replace
```

```
gen lag1 = Volume[_n-1]
```

```
* Set data as panel data
```

```
global id          Company
global t          Date
global ylist      StockReturn
global xlist      Dummy DividendYield BidAsk Volume lag1 Volatility InterestRate SP500Price
                  SP500Volume
xtset $id $t
```

```
quietly xtreg $ylist $xlist, fe
estimates store fixed
quietly xtreg $ylist $xlist, re
estimates store random
hausman fixed random
```

```
quietly xtreg $ylist $xlist, re
xttest0
```

```
eststo: xtreg $ylist $xlist, re
esttab
eststo clear
```

```
* Hypothesis 5
```

```
import excel "C:\Users\A\Documents\DataMTScriptie.xlsx", sheet("Data4") firstrow clear
destring, replace
```

* Set data as panel data

global id Company

global t Date

global ylist PriceReversal

global xlist Dummy DividendYield BidAsk Volume Volatility InterestRate SP500Price SP500Volume

xtset \$id \$t

quietly xtreg \$ylist \$xlist, fe

estimates store fixed

quietly xtreg \$ylist \$xlist, re

estimates store random

hausman fixed random

quietly xtreg \$ylist \$xlist, re

xttest0

eststo: xtreg \$ylist \$xlist, re

esttab

eststo clear