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The Extent of Retail Trading Risk: The GameStop Case

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Anno Accademico 2020/2021

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1. Introduction

During the initial months of 2021, a short squeeze of the GameStop stock organized by a group of retail investors caused quite a stir among the financial community because of its unparalleled proportions and dynamics. This paper attempts to dig deep into the causes of the phenomenon by exploring how subtle and biased mental processes inherent in the human mind affect the mechanisms that lead investors to injudicious conclusions concerning financial investments, which, in turns, translate into various market inefficiencies. Evaluating the possible implications of the interference of inexpert investors in trading dynamics is crucial in order to understand the magnitude of the threat they bring about in terms of risks for financial market stability. In the absence of specific triggers for market shocks, retail investors already in themselves are deemed responsible for destabilizing aspects like excess volatility and substantial changes in trading volume that influence market supply and demand equilibria; that said, if we also consider the recent expansion of technological research that allowed for the huge increase in people's ability to exchange of information due to the impact of modern communication tools, the extent to which retail investing may alter the efficient functioning of financial markets becomes of particular interest for both institutional investors and market regulators.

Recent literature has invoked several motivations as so to achieve a comprehensive understanding of the reasons underlying individual investors' chaotic market behavior, the most important being the inability to include rational arguments in their decision-making processes: ignorance of financial tools and dynamics, combined with a severely biased mindset, lays the foundations of their disorganized approach to trading. Retail investors are often inclined to mistake their lack of rationality for a strength capable of placing them in a superior position with respect to the market, ignoring the fact that, in many occasions, their misperceptions on stock prices and market trends have proved to be a double-edged sword, as they are just as exposed to the disturbances that they themselves have created as the market they were trying to beat: individual investors are, in fact, incapable of outperforming the market on a sustained basis, as shown by significant studies and abundant data collected over the years.

In the effort to affirm that the degree of the hazard brought about by individual investors is relatively insignificant for the overall solidity of financial markets, the issues presented above will be addressed with the aid, when it is deemed appropriate, of two relatively modern approaches to financial analysis, behavioral finance and market microstructure. This paper is therefore structured in two main chapters, the first including the context and motivations of the GameStop case, the second giving reasons for the possible risks created by retail investors and the way they are counteracted, and a final section where conclusions are drawn.

2. The context

2.1 Study Approach

2.1.1 Behavioral Finance

Behavioral finance is a branch of economic research which does not view the financial world as a sterile cluster of numbers, but rather allows other forces to intervene in the dynamics of financial markets. We could say it encompasses theories from both the financial and psychological fields in the attempt to explain what the underlying reasons for market anomalies, bubbles and stock price volatility are and in general give a clearer and broader framework to analyze all of the phenomena which cannot apparently be explained by traditional finance theory.

A brief history

Research on behavioral finance began to emerge no earlier than the 1980s, before then, the leading and undisputed theories on financial market undercurrents were what we nowadays define as "standard" or "traditional" finance. Shaping the framework of traditional finance are two main theories: the Efficient Market Hypothesis (EHM) and the Expected Utility Hypothesis.
Fama (1965) was the first economist who brought forward the hypothesis that markets are perfectly efficient, in the sense that stock prices perfectly embody all available information at all times (meaning that their realized market value is always a fair value) and they automatically adjust to new flows of information. Part of his research also consisted in discovering that, since stock prices do not follow precise paths, their formation was totally random and did not reflect past trends. (1)
The Expected Utility Hypothesis is still a widely accepted theory in the field of decision-making studies. At the basis of this theory is the concept of how individuals make rational decisions when faced with complex situations taking into account the maximum utility that they can get from each option. Von Neumann and Morgenstern laid the foundations for the hypothesis by expressing the pool of choices as a function of their outcomes, and stating that, in any situation, a rational investor will try to maximize the expected value of their choice.
However, as correct as these theories may seem, they do not take into account the fact that markets are not, in fact, perfectly efficient, and decision makers do not embody complete rationality; hence, the development of more modern theories.[1]

[1] https://en.wikipedia.org/wiki/Von_Neumann–Morgenstern_utility_theorem

Even though some concepts described by traditional finance still stand strong, starting from the 80s, researchers have been loath to consider market agents as perfectly rational and markets perfectly efficient: suffice it to say that major market shocks, such as market
bubbles in Japan (caused by hyperinflated real estate and stock prices between 1986 and 1991), Taiwan (1989) and the US, just to name a few, required more exhaustive explanations, and traditional finance just did not make the cut.

Advocates of behavioral finance are Kahneman and Tversky, two psychologists who redefined the approach to studying the decision-making processes of investors; in their work "Prospect Theory: An Analysis of Decision under Risk" (1979), they questioned the efficacy of the expected utility theory in explaining people's choices. In fact, they found that the mechanics behind decision-making are driven by the potential for losses or gains rather than a rational weigh-out of utilities in different investing possibilities. This occurs because people tend to show risk or loss aversion when faced with a risky situation, thus they will most certainly gravitate towards safer options despite possibly lower utilities. (2)

Extending the psychologists' prospect theory was Richard Thaler in his work "Toward a Positive Theory of Consumer Choice" (1980), through which he opposed the central idea of the rational maximizing model that consumers rationally make choices on what to buy based on a thorough examination of all the information they had. He pointed out how the human mind could fall into error by not taking into account opportunity and sunk costs and by "choosing not to choose"[2], that is, regret aversion. (3)

What influences investment decisions

Consequent to recent literature and discoveries is the fact that investors' rationality is more than often misled by cognitive biases and external influences which do not allow for weighted and thought-through decisions. Cognitive biases, among the most common, are self-deceptive behavior, heuristics, and emotions, while external influences include all social factors that play a role in modelling one's own thoughts and mental processes involved in investment decisions. Within those concepts lay the possible explanations for unsuccessful investment decisions and the other phenomena presented in this paper.

[2] Thaler R. *Toward a Positive Theory of Consumer Choice*. Ithaca: Cornell University; 1979

2.1.2 Market Microstructure

On the other hand, the analysis of the elements of disturbance mentioned above require the application of more practical methods. Maureen O'Hara, in her book "Market Microstructure Theory", pioneered the exploration of the mechanics underlying the trading processes in financial markets and the way different market structures (defined by precise trading rules) play a role in influencing transaction costs, information about assets, prices and their possible volatility, trade volumes and the behavior of investors.

Hence, market microstructure fundamentally translates into the analysis of its two key concepts: trading mechanisms, which refer to the type of market, types of orders, forms of trading, transaction transparency and price discovery; and market regulations, which define the rules by which the actors in the market must play. (4)

The way traders behave largely depends on the specific structure of the market they are operating in, and in turns trading behavior influences other factors such as market liquidity and price volatility.

2.2 The Case

In order to avail ourselves of the products of the fields of study described above, it is necessary to conduct an examination of the key concepts presented above, it is necessary to carry out a preliminary analysis of the main events that constitute the GameStop case and their underlying motivations.

Gamestop, a NYSE-listed American company operating in the videogame retail industry, has been in the public eye during the months of January and February 2021, after its stock underwent a short squeeze that generated significant market instability.

At the time, considered that the company's financial well-being was at risk, numerous institutional investors and hedge funds, convinced that prices would have decreased even further, took short positions on GameStop shares, to the point that almost 140% of its float consisted of shorted shares. Short selling is a strategy that investors apply when they are expecting a certain stock's price to decrease. When investors short sell they do not actually own the stock: they actually borrow it and sell it with the prospect of buying it back when its ask price (the buying price) will be lower than the bid price (the selling price).

By contrast, some retail investors who were monitoring the situation, came to the conclusion that, given that, in their opinion, GME shares were extremely undervalued, investors who had taken

short positions on the market were vulnerable to a market phenomenon called short squeeze. A short squeeze occurs when stock prices rise instead of decreasing and on condition that there is a considerable amount of short positions on said stocks.
In order to trigger the squeeze, those retail investors spread the voice through Reddit, a social media platform where registered users share content on forum-like pages. Specifically, r/wallstreetbets, a subreddit where people exchange opinions on generally risky shares and options trading, represented the means though which many retail investors were persuaded to take long positions on GameStop's shares. Through online and commission-free brokerage platforms, such as RobinHood, investors with little to no experience were able to invest their savings, with the result that the price of the stock escalated reaching by the end of January its all-time-high level of $347.51 per share, as opposed to the $17.25 per share measured at the beginning of the month. At that point, short positioned investors were left with two options: either buy back the shorted shares at the higher prices as soon as possible in order to minimize their losses (action that, still, resulted in huge losses for institutional investors), or choose to hold the shares in the hope for an inversion of the increasing trend.
During the following months, the market struggled to restore its stability due to the excessive amount of volatility caused by the squeeze, and the trend of the shares' price kept experiencing sudden and uncontrollable reversals[3].

2.3 Motivations for the Short Squeeze

Applying some of the concepts belonging to behavioral finance, as well as others, we can trace a thorough description of the possible driving forces of the phenomenon.
Motivations underlying the short squeeze are various and range from social involvement driven by moral reasons to implicit psychological dispositions that may have indirectly affected the investors' behavior.

2.3.1 Ethical Motivations

Political activism factors certainly played a role in giving rise to the episode, but the influence of emotions must not be set aside when analyzing the motives for such event. Resentment about the 2008 crisis economic consequences stirred up hatred against Wall Street among retail investors, many thought of the squeeze as a way to give the Wall Street hedge funds a taste of their own

[3] https://en.wikipedia.org/wiki/GameStop_short_squeeze

medicine after having allegedly given rise to the financial crisis; some took it as their own responsibility to avenge failing companies, such as GameStop, by battling institutional investors and hedge funds that were betting against them; and still others were driven by an unmotivated hostility against billionaires trading in financial markets in general, as demonstrated by numerous statements made by those who took long positions of GME shares: "*I would buy magic beans on the street from a stranger if he said they had the potential to ruin a billionaire's life.*" or "…*I love the idea of bankrupting some hedge funds — that would be fantastic.*"[4]. These motivations translated into an outright battle against Wall Street and its agents[5].

2.3.2 Behavioral Implications

Ethical considerations aside, there were other reasons why people decided to invest in GameStop which can be reconducted to cognitive biases studied by the field of behavioral finance. Some of the behavior exhibited by GameStop retail investors has important implications in terms of cognitive dissonance, denoting that many weren't investing with full knowledge of the facts, but rather were influenced by their own irrationality. Among those we find herding, overconfidence and framing bias.

Herding

Herding refers to the tendency of people to emulate other people's behavior when it comes to making decisions. This inclination towards "the group" originates from the investor's belief that when a numerous people are following the same path, then they must be holding more valuable information about stocks and therefore must be making the right predictions on what to invest in. While it is applicable to all kinds of situations, this social influence comes in particularly handy when trying to explain investing patterns in the stock market: Venezia, Nashikkar, and Shapira (2011), in one of their recent works, were able to identify a positive correlation between the volatility of stock prices and the tendency of people to copy others' actions. (5)
At the heart of this belief lay two main factors: skepticism about one's own analyses (people tend to have low consideration of the information they possess); and the fear to go against the grain, firstly because people find satisfaction in being part of a group and share the same beliefs and experiences with it, secondly they do not feel at ease with the idea that they could miss out on considerable gains if they do not follow the "herd".(8) "*I am holding it to be in solidarity with others… it's*

[4] https://www.latimes.com/business/story/2021-01-29/the-gamestop-brigade
[5] https://studentsforliberty.org/north-america/blog/gamestop-short-squeeze/

something I don't usually do — public market investing — but it felt good to be investing in something alongside hundreds of thousands of other people."[6].

Herding has long been juxtaposed to the strategy of momentum trading, a trading technique which focuses solely on price trends: investors who use this technique decide to take a position on some stock when they notice a strong trend in that stock's price, believing its underlying forces are strong enough to keep the trend alive long enough to take advantage from it. When the price of a stock undergoes a constant increase for some period of time, it will inevitably attract the attention of traders and investors, thus explained the reason why many retail investors started buying GME shares just for the sake of riding the wave[7].

The fact that people move in herds may be the most relevant cause for bubbles in the market: if some type of stock investment seems profitable to a few, other people will subsequently start investing in it, driving its demand upwards and increasing prices to unsustainably high levels until nobody will be willing to buy, causing the bubble to burst, (which eventually happened with GameStop). (6)

Framing bias

Moreover, many retail investors' opinion on the GME stock was manipulated by the investors who first ignited the short squeeze, who persuaded many to join their quest for destabilizing the market, as well as the support given by prominent figures such as Elon Musk (an actual member of the r/wallstreetbets forum on Reddit and is referred to as "Papa Musk" by Reddit users) after his famous Tweet "*Gamestonk!!*"[8].

The inclination towards being influenced by how a certain thing is presented to them is denoted by the term framing bias. The key concept is that people may be more prone to make some decision if the problem is articulated in different ways. Specifically in finance, when an investor is faced with the choice between a pool of stocks to invest in or between keeping or liquidating one they already hold, and they are lacking information enough to infer what are their best prospects, the way the different stocks are "proposed" to them will impact his reasoning differently. (7)

Heuristics

The human brain can sometimes operate in subtle ways, often people perceive their decision as a rational one, when in actuality they have involuntarily taken some sort of shortcut in order to simplify the decision. These shortcuts are referred to as heuristics and can be described as rules of

[6] https://www.latimes.com/business/story/2021-01-29/the-gamestop-brigade
[7] https://www.investopedia.com/trading/introduction-to-momentum-trading/
[8] https://twitter.com/elonmusk/status/1354174279894642703

thumb that people knowingly or subconsciously apply when they determine which actions to take. These rules may arise from personal past experiences or deep-rooted investing habits, however, it was discovered by Benartzi and Thaler (2001) that the most commonly used rule is the 1/N rule: it consists of investing an equal share of savings per fund available. Normally investors would tend to hold a greater quantity of "safer" stocks and diversify through incorporating higher risk assets and although the 1/N rule does guarantee some form of diversification, it does not account for the amount of risk that can derive from investing in each fund, it just allocates financial resources uniformly. (8)

2.3.3 The Effect of Communication

Another important factor to take into consideration in order to explain the magnitude of the case is the influence of new technologies and new communication portals. In fact, before the GameStop case, never had financial markets experienced a market crash of such scope caused by retail investors, who are typically considered to have very little influence on market movements[9]. The fact that investors were able to organize is the major reason for which they were able to reach such achievement, and if they eventually come to the realization of the power that communication platforms give them in this sense, they might drastically change financial market dynamics.
Of particular interest are the two platforms employed by investors to cause the short squeeze: r/wallstreetbets, a forum on Reddit where people give each other financial advice and exchange opinions on their respective trading activities, and Robinhood, a retail brokerage platform which offers the possibility to trade assets without incurring in commissions fees.

Sprout Social, a social media managing platform, gathered data on the social media activity related to the GameStop case measuring the online engagement of internet users on the topic. The results give outstanding insights on how the short squeeze was conducted. During the week preceding the price peak, Google counted more or less eighty thousand "GME" mentions, aside from the one and a half million Tweets and more than one thousand YouTube videos on the topic, accounting for a 2,805% growth in volume; moreover total engagements throughout all social media networks exceptionally measured almost three million. These results are consistent with the price increase occurred in the same week, as shown in the graph. In light of this data, the consequences of online

[9] https://cheddar.com/media/reddit-revolt-shifts-national-conversation-to-state-of-financial-markets

communication are self-explanatory: this event is the proof that such platforms are actually capable of overturning market trends[10].

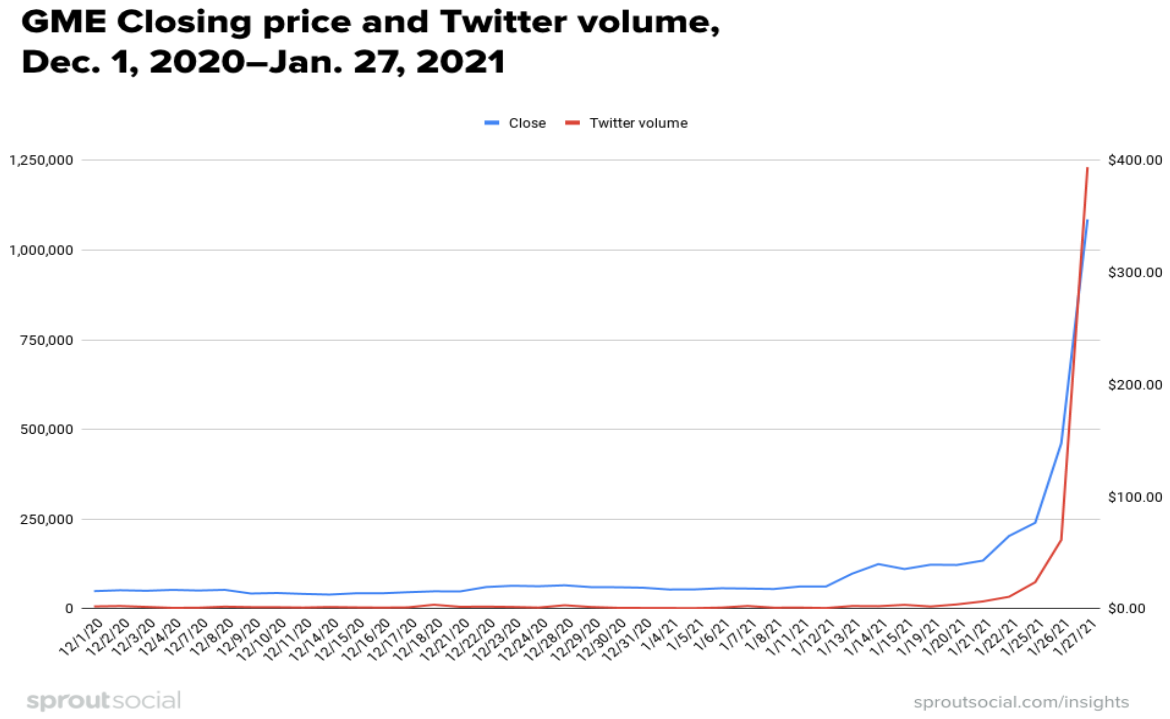

Figure 1: Relationship between GME closing prices and Twitter volume

However, doubts have arisen on the rightfulness of the way social media is being used. It is not just an information exchange anymore: such behavior leads to think that regulators may be facing a serious unprecedented case of collusive behavior.

However long the list of market manipulation cases, none of these draws near to the way the GameStop case is articulated, hence the difficulty of assessing whether Reddit users' actions fall under the field of manipulation, especially collusion[11]. The burden of proof is on the Securities and Exchange Commission, which had been keeping a close eye on the evolution of the phenomenon and claimed it would ensure that markets function correctly and efficiently[12]. Nonetheless, the lawfulness of the squeeze's actors is still put under scrutiny as many believe that the pressure put on stock prices by a few individual investors was a result of manipulation, as creating false trading signals can be seen as a manipulative action, and that the collective organized action lay the

[10] https://sproutsocial.com/insights/gamestop-stock-social-media/
[11] https://cheddar.com/media/market-manipulation-in-gamestop-case-hard-to-prove-says-legal-expert
[12] https://cheddar.com/media/market-manipulation-in-gamestop-case-hard-to-prove-says-legal-expert

groundwork for collusion. Traders' behavior may fall under the legislative scope of Section 9, Securities Exchange Act (1934), on the "Prohibition against manipulation of security prices":

"SEC. 9. (a) It shall be unlawful for any person, directly or indirectly, by the use of the mails or any means […]

(1) For the purpose of creating a false or misleading appearance of active trading in any security other than a government security, or a false or misleading appearance with respect to the market for any such security, […] (B) to enter an order or orders for the purchase of such security with the knowledge that an order or orders of substantially the same size, at substantially the same time, and at substantially the same price, […] has been or will be entered by or for the same or different parties…"[13]

"(2) To effect, alone or with 1 or more other persons, […] creating actual or apparent active trading in such security, or raising or depressing the price of such security, for the purpose of inducing the purchase or sale of such security by others."[13]

As stated in the Act, it is prohibited to affect stock prices by any means if the intent is to reshape the appearance of trading and of the assets' market conditions, as well as pressuring prices in order to induce some desired behavior by others (in this case, exerting an upward pressure on GME shares to force institutional investors and hedge funds to buy back the shares), as well as entering into certain transactions knowing that other investors will place orders of similar size and price during the same period of time. The final outcome of the discussions would seem straightforward, was it not for the fact that, in identifying these elements, it is challenging to recognize malice in the behavior of retail investors as opposed to surrendering to the idea that they simply jumped on the trend because of the strong stock momentum and the psychological biases illustrated above.

[13] Securities Exchange Act Of 1934

Moreover, the issue arises on whether participants in the short squeeze were acting as an organized group, which by law, Sec. 13(d) Securities Exchange Act, would require disclosure if at any time the group was aggregately holding more than five percent of GME's shares. The text reads:

SEC. 13. (d)(1) Any person who, after acquiring directly or indirectly the beneficial ownership of any equity security […]and is directly or indirectly the beneficial owner of more than 5 per centum of such class shall, within ten days after such acquisition […] file with the Commission, a statement containing such of the following information…

(3) When two or more persons act as a partnership, limited partnership, syndicate, or other group for the purpose of acquiring, holding, or disposing of securities of an issuer, such syndicate or group shall be deemed a ''person'' for the purposes of this sub- section."[14]

As stated in *(3)*, two or more people acting as a group are considered to be a single person, therefore the total number of shares must be taken into account; if their aggregate holding resulted to be higher than five percent in any moment of the squeeze, then they were ought to communicate information such as their personal data, the nature and size of their investment, the number of shares held, and, above all, they must disclose any form of agreement or arrangement. The law does not require the intention to hold more than 5% of the shares for the action to be unlawful, however, it is mandatory that all individuals are proven to have entered an agreement in order for them to be considered as a group, which may not be feasible as the exchange of information on social media does not represent sufficient evidence of such agreement. (9)

What is certain, on the other hand, is that this event paves the way for similar episodes, as now people are becoming more and more committed to the belief that social media are a powerful means of communication and can help achieve such collective actions.

[14] Securities Exchange Act Of 1934

3. Risks for Financial Markets

3.1 Institutional Investors Losses

Needless to say that, in the GameStop short squeeze, the counterpart that lost out the most consisted for the most part of institutional investors and hedge funds, in other terms, who had shorted GME shares. On January 26th short sellers had already lost six billion dollars, and losses inflated substantially after the $347 price peak on January 27th, amounting to a total of almost twenty billion dollars. Some of the best-known and most successful hedge funds incurred huge losses: according to Bloomberg Melvin Capital was forced to close its short position on the 27th after registering losses up to 53%[15], Point72 incurred a 15% loss, but the biggest loss was suffered by Citron Research, which not only lost 100% in the attempt to cover its position, but also announced it would divert its energies towards reports on bullish investments rather than shorts[16].

In the light of these events and their consequences, a crucial issue arises: how much of a threat can these people be to financial markets stability? Are new communication platforms a gateway for an overturning of powers among investors?

Typically stock prices do not undergo such abrupt and considerable fluctuations because of the counteracting activity of arbitrageurs who trade against destabilizing retail activity. However, we must also recon that arbitrageurs are normally risk averse, and too high of a risk may disincentivize them from taking action, or simply, price changes might me so significant that bringing them down to their fundamental levels might not be as easy as it seems. (10) The analysis that follows attempts to give a general idea about how different elements of market microstructure, such as volatility, volume, liquidity and market misperceptions, interwove and helped shape the price path of GameStop's stocks, as well as highlighting some of the risks that affect financial markets.

3.2 Noise Trader Risk

Broadly speaking, traders are distinguished between informed and uninformed. Informed traders, also known as information traders, who enter financial transactions because they hold information on future market trends which is not widely available, giving them a considerable advantage on other investors; on the other side of the spectrum stand all individuals who trade for non-informational reasons, mainly because they seek liquidity (the ease at which an asset can be exchanged for cash. (11)

[15] https://markets.businessinsider.com/news/stocks/melvin-capital-gabe-plotkin-took-home-846-million-in-2020-2021-2
[16] https://fortune.com/2021/01/29/gamestop-stock-how-much-hedge-funds-have-lost-sellers-losses-gme-steve-cohen-point72-andrew-left-citron-research-short-squeeze/

The extensive presence of liquid assets in a market is essential to ensure that transaction costs are kept at relatively low levels and it determines the extent to which a market can execute orders leaving stock prices almost unaltered, the corollary being that, for a price change to happen, a considerably large orders must be made[17] (which is the case with GameStop stocks, the trading volume of which underwent a great increase during the squeeze).
GameStop is listed in the New York Stock Exchange (NYSE), the world's deepest and most liquid stock exchange and this last characteristic acts as the main attraction especially for uninformed traders who seek profit without incurring in the substantial trading costs they are normally subject to (as opposed to institutional investors who typically face negligible or non-existent costs). This translates into the fact that GME shares represented a profitable opportunity for many retail traders, but also that their conspicuous presence may have been destabilizing for the market.
Various researches validate the hypothesis that retail investors account for the majority of the volatility displayed by stock prices.

3.2.1 Retail Investors and Volatility

Brandt, Brav, Graham and Kumar (2010) carried out an analysis of the implications of the presence of retail investors in stock markets and their correlation with the idiosyncratic volatility that episodically affects stock prices and returns. Their study reveals that low-priced stocks exhibit a higher concentration of retail traders, as opposed to institutional investors, which may be attributable a variety of reasons, for example the attractiveness of the high returns opposed to institutional investors' risk aversion.
This finding allowed them to prove that retail investors do have an impact on stock prices and volatility: further tests revealed that the presence of volatility was stronger in low-priced stocks, demonstrating the positive relationship between retail trading and the increase in stock volatility. (12)

A year later, Foucault, Sraer and Thesmar (2011) came to the same conclusions after finding that retail investors are responsible for 23% of stock volatility, however, they added an important consideration to the study by Brandt et al. by identifying that many retail traders shared similar characteristics with noise traders. For the purpose of this paper, we must take a close look at noise traders as many of the retail investors involved in the GameStop short squeeze are likely to fall into this category. (13)

[17] https://cleartax.in/g/terms/market-depth

In Stoll's words (1992), noise traders can be defined as "*traders who believe they have information but, in fact, do not*."[1]. (14) These traders typically implement strategies based on trivial beliefs and emotional drivers: as a consequence, their decisions are anything but well-advised and informed. Market actions brought forward by noise traders are often powered by an exogenous event or disclosure of some piece of information which they believe to be the key to a successful investment; this is a clear example of psychologically-biased reasoning, which is a crucial topic in this paper. (12)

Foucault et al. hypothesized that retail traders contribute to the increase in volatility if they do, in fact, behave as noise traders, which would imply finding results coherent with the dynamics described by noise trading models. Following an experimental increase in transaction costs for retail investors, they found that, not only the amount of volatility that affected stocks traded by retail traders substantially decreased, but also that those stocks underwent less significant price reversals, as predicted by noise trading models. (13)

3.2.2. Noise Trading Model

In this matter, De Long, Shleifer, Summers and Waldmann (1990) had developed a noise trading model in order to aid the explanation of such financial market anomalies, explaining that changes in asset fundamentals account for only a small part of asset price volatility and that the reason for some assets' excessive price movements lies elsewhere, namely in the influences of noise trader behavior. Actually, the model was based on the assumption that said asset is free of fundamental risk, in order to see what other variables affect its price formation.
The model is constructed as follows:

- There are two types of traders, noise (n) in number μ, and sophisticated (i) in number $(1-\mu)$
- They both try to maximize their utility by choosing their portfolios at time t among two kinds of assets, a safe one (s) and a risky one (u)
- The assets share the same fundamentals (for instance a riskless rate of return r) and no change in fundamentals is assumed[18].
- The choice is based on their expectations about the mean distribution of the price of the risky asset in the subsequent period (t+1)

The crucial difference concerning the last point is that, while sophisticated investors make accurate predictions, noise traders are biased by the belief that market noise provides them with information

[18] Condition to prove that the majority of volatility is caused by noise and not fundamentals.

that will lead them to a successful interpretation of the asset's value (Black 1986), when in actuality they are overestimating the price of *u* by a factor of ρ_t (measure of noise traders misperception).

They then proceed by expressing the price of *u*, p_t, as:

$$p_t = 1 + \frac{\mu(\rho_t - \rho^*)}{1+r} + \frac{\mu\rho^*}{r} - \frac{(2\gamma)\mu^2\sigma_\rho^2}{r(1+r)^2}$$

where ρ^* measures the bullishness of noise traders (which tends to drive price up), σ_ρ^2 is the variance of misperception and γ is the coefficient measuring risk aversion of sophisticated investors.

Breaking down the formula it is clear that the price (and its volatility) of the risky asset is a function of the number of noise traders in the market and their misperceptions.

1. $\frac{\mu(\rho_t - \rho^*)}{1+r}$ is a representation of how the shifts of opinion of noise traders move prices: the more bullish the traders (so the higher ρ^*), the more the price is bidden up. It also shows the positive correlation between the number of noise traders μ compared to that of sophisticated ones and the impact of noise traders' misperceptions. The considerable impact of noise on prices prove that its presence in financial markets cause excess volatility.
2. $\frac{\mu\rho^*}{r}$ measures the extent to which prices diverge from their fundamental value due to the upward pressure forced by bullish investors.
3. $-\frac{(2\gamma)\mu^2\sigma_\rho^2}{r(1+r)^2}$ represents the fact that sophisticated investors are willing to hold the risky asset only if its return is higher than the risk that its price will fall due to the changes in noise traders' expectations. (10)

3.2.3. Price Reversals

Despite the fact that noise trading models typically predict that these kinds of traders will eventually lead to price reversals, De Long et al. point out that there is the possibility that, if noise traders were proved right about their predictions (the misperceptions examined) by the realized market trends, their expectations about future market trends are kept high and impede prices to change path for a considerably long time. In other words, the condition under which asset prices revert to their mean is that misperceptions of noise traders are temporary. (10)

However, the hypothesis brought forward by noise trading models is backed up by evidence found by Fama and French, who demonstrated the presence of negative serial correlation of stock returns in the long run, which in turns suggests the strong possibility for price reversals. (15)
Moreover, according to information-based models, the extent and the frequency of information exchanges, and especially the speed and intensity with which investors respond to said information are crucial in order to determine the entity of the price reversal. (16)

Investors have been found to respond quickly to new information about stock prices (17) (also due to the fact that information on market dynamics can be found in real time with the simple aid of an internet connection), and, given the sudden fall in the stock price and the consequent behavior of the many investors who covered their long positions, it is not difficult to predict that they have, in fact, changed their opinions leading to a general discouragement towards investing in GameStop shares. However, while a prompt reaction to changes in price is generally desirable for investors, those who had invested in GME shares exhibited rather an overreactive behavior.

3.2.4. Overreaction

There are sufficient behavioral studies that prove that irrational investors tend to overreact to sudden changes in the market and let their emotions drive their investment decisions. Thaler and De Bondt have pioneered the hypothesis that psychological biases such as overreactive responses to unanticipated pieces of news about stocks may be the source of price reversals in the presence of high volatility. They empirically demonstrated that some unexpected event (like the overnight GME shares' price drop) is responsible for extreme changes in expectations on the part of investors because of their tendency to overstress the trend's turnaround. In turns, modifications in investors' expectations may cause an even more significant price movement in opposite directions, proportional to the size of the initial price shift. (18)

In turns, overreaction can lead to abnormal levels of trading volume, especially in circumstances, such as the GameStop case, where traders seem to chase investing fads. Fads refer to usually short-lived investment crazes that are distinguished by traders' typical eagerness to invest in in such stocks due to their conspicuously large and short-term expected returns. Trading fads are generally the result of the behavior of inexpert investors who make investment decisions without taking into consideration the whole picture, but rather falling into the herding trap discussed above. (19)
Trading fads, due to investors' lack of information (recalling Stoll (1992), participants in the market squeeze only believed they had informational advantage regarding stock prices), display a rapid increase in trading volume, also due to an expansion of the quantity of people who engage in trading activities, which was proved to be positively correlated with the amount of trading volume, and that the latter is associated to higher price volatility. (20)
The subsequent sudden price changes, however, are likely to catch investors off-guard and to discourage possible future investments. The consequence of reversals is that trading volume considerably decreases because of the many investors who choose to focus on relatively safer assets or exit the market once for all, circumstance that occurred after GME shares had lost most of their value, leading many US citizens not to further invest their stimulus check.
Figure (2) shows the strict correlation between trading volume and GME share prices for the moths of January through March 2021[19].

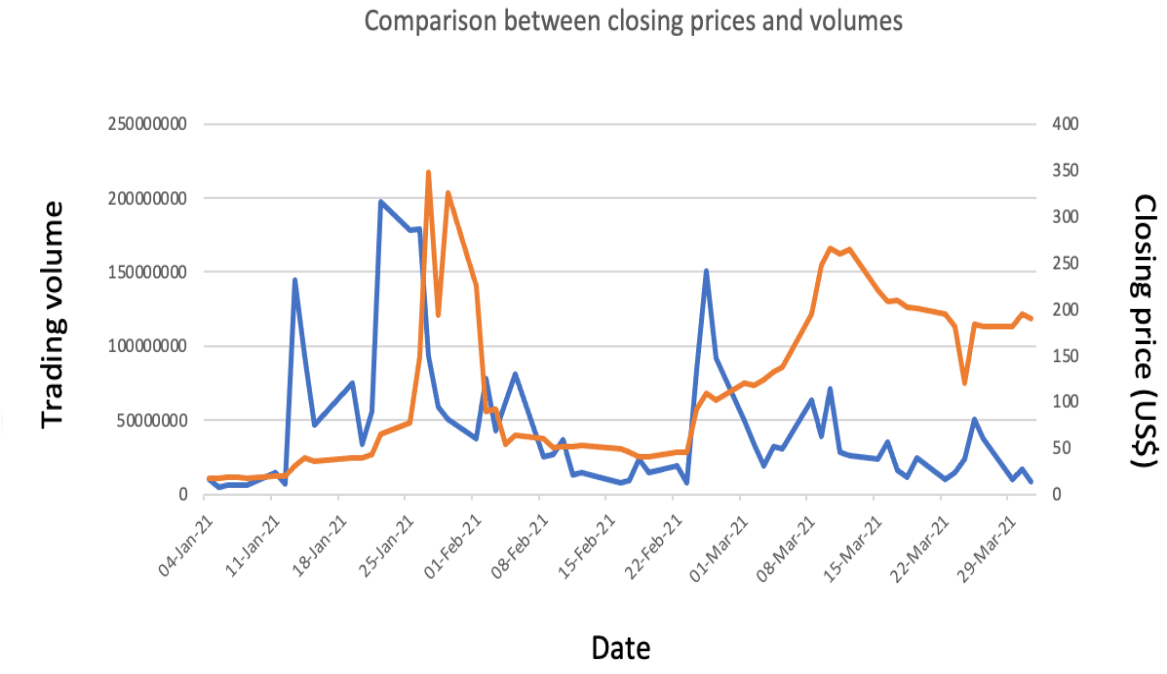

Figure 2: Comparison between GME closing prices and trading volumes

[19] https://www.nasdaq.com/it/market-activity/stocks/gme/historical

3.3 Underperformance

The considerations listed above hypothesize that individual investors' irrational behavior can be extremely detrimental for their earnings. In the financial environment, retail investors are often referred to as "dumb money", not because they lack intelligence, but possibly because they are more prone to making mistakes when investing. In fact, often they don't have access to advanced financial instruments, or updated databases, or lack deep knowledge of financial concepts, and, above all, they are more vulnerable to biases than institutional investors.

Miseducation, as well as psychological biases, have proved in many occasions to be the cause of individual investors' underperformance, beginning with the case we are analyzing.

According to data provider VandaTrack, just after the GameStop squeeze, the fall in prices caused retail investors to earn by less than 11%, on average, with respect to the S&P 500 Index, causing the amount of assets traded to decrease. This occurrence is not new if compared to past similar trends: a decrease in stock purchases by retail investors was measured after retail investors lost 14% of their investments made on Apple and Tesla stocks the past September[20].

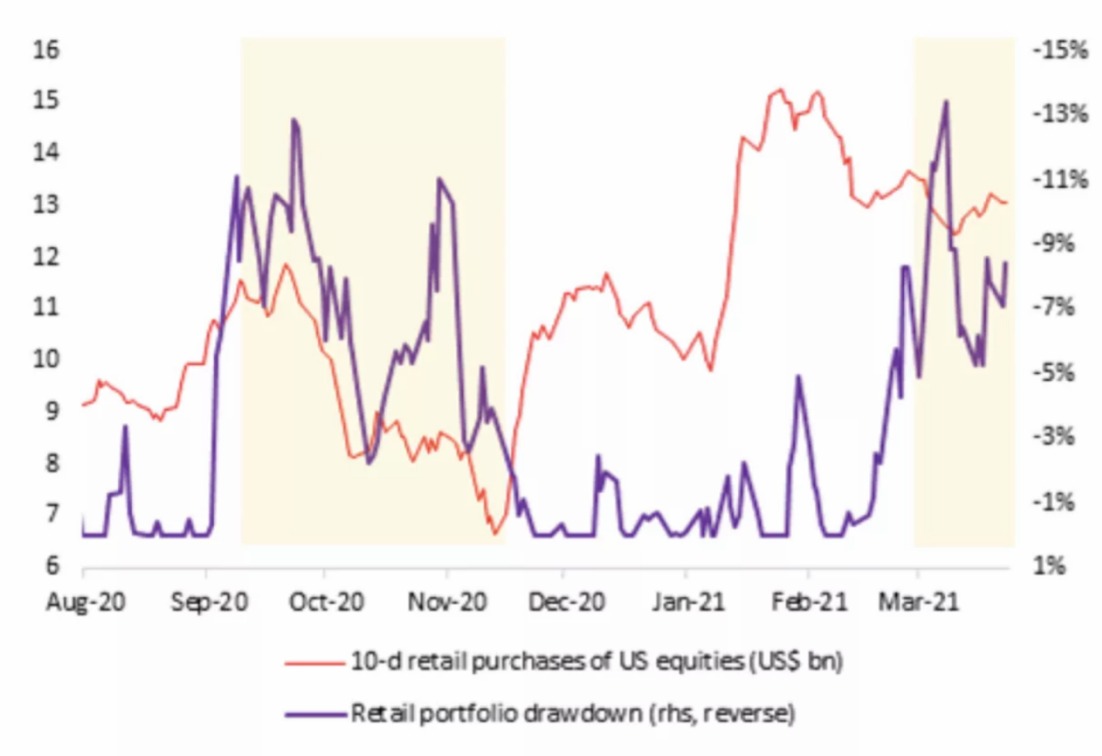

Figure 3: Comparison between retail purchases of US equities and retail portfolio drawdown.

[20] https://www.investopedia.com/retail-investors-are-underperforming-the-market-5118497

Such data is coherent with the findings of previous studies where it emerges that, generally speaking, individual investors tend to be underachievers in the long run compared to institutional investors and mutual funds. Barber, Lee, Liu and Odean (2008) validated the hypothesis that institutions have greater advantages in trading because of their superior skills, as opposed to the "aggressive orders" placed by individuals, by simulating the market behavior of both types of investors and analyzing their respective performance in terms of cumulative abnormal returns. Results reveal that, while institutional investors' purchases top stock sales by 80 bps after one month of trading, purchases by individuals were 10 bps below sales in the same period of time; data is even more significant when considering a six-month time frame: stocks bought versus stocks sold were valued by a difference of 150 and -20 basis points for institutional and retail investors respectively. (21)

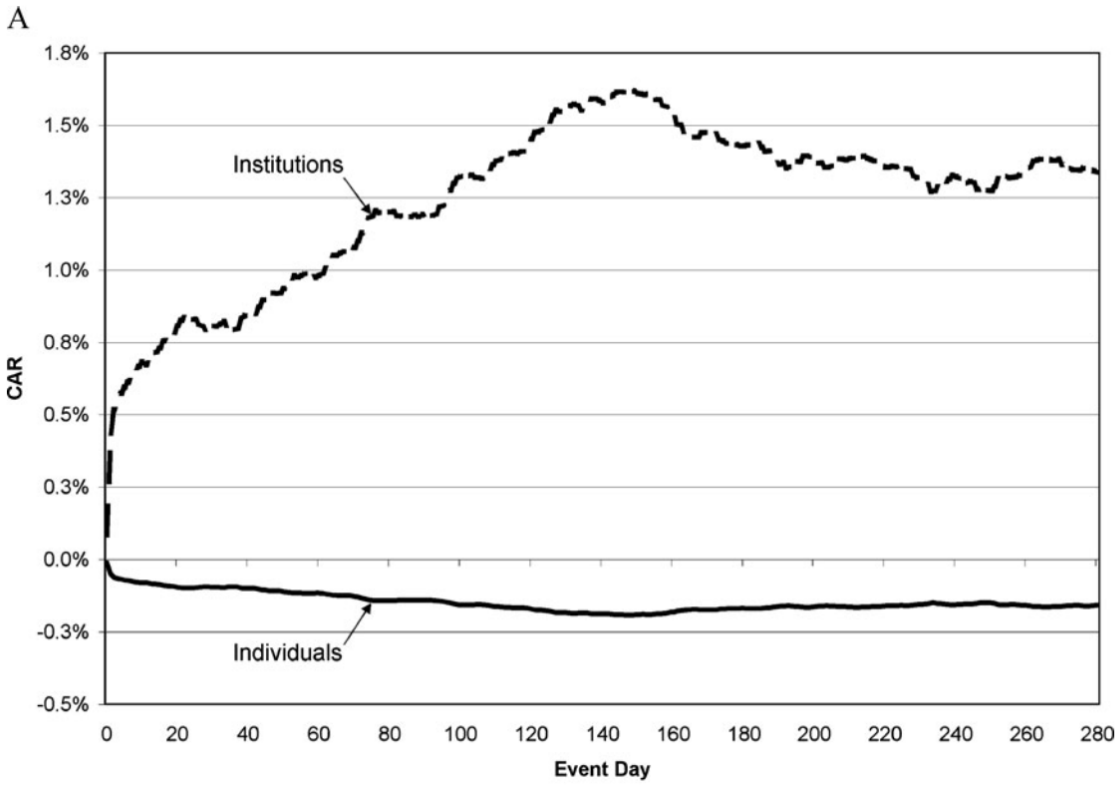

Figure 4: Cumulative abnormal returns in event time for stocks bought less stocks sold by institutions and individuals

Another study conducted by Barber and Odean (2000) came to the same conclusions after analyzing a sample data of almost eighty thousand households and comparing the returns they earned with other market means. Individual investors were found to earn little expected returns compared to the average market earnings.

Some of their findings include that, on average, individual investors who trade excessively are bound to gain less (11.4% annual return) compared to individuals who do not trade as often (18.5%). They theorize that the high frequency of trading might be the cause of retail investors' underperformance, and in turns, persistent trading might be the result of investors' overconfidence. According to overconfidence models, these kinds of investors tend to overvalue the information they hold, leading them to apply active and frequent investment strategies instead of passive ones (individual investors' portfolios undergo a 75% annual turnover on average). However, it is proved that, since the occurrence that single investors hold private information is rare, and usually the information referred to is incorrect or irrelevant, aggressive strategies are not able to offer positive outcomes: it is predicted that high-turnover portfolios exhibit lower expected utilities compared to portfolios that are modified less frequently.

Coherent with these models, Barber and Odean (2000), by analyzing net returns of both types of portfolios, found that portfolios held by overconfident investors who trade excessively earn, on average, returns which are inferior by 5.5% to even 9.6%. (22)

3.3.1. Overconfidence

Overconfidence may occur for various reasons: an interesting finding by Bornstein and D'Agostino (1992), which was then expanded by other scholars, is that overconfidence stems from a more or less extensive knowledge about certain investment opportunities: the better one knows (or believes they know) the stock they are bound to invest in, the less the risk they perceive, hence the mental bias of investing more in familiar stocks with disregard for the actual data. The direct consequence is the creation of poorly diversified portfolios, which in turn increases overall risk.
Furthermore, people misinterpret the actual probabilities of a successful outcome and tend not to learn from past mistakes, they tend to be overly optimistic and end up making risky decisions believing they have high probabilities of achieving a favorable result as well as facing considerably higher trading costs and incurring losses due to wrong timing for buying or selling. (23)

In fact, a small but considerable part of losses is usually due to the inability to time decisions correctly: usually individual investors make poor predictions about stocks future value, which would allow them, for example, to invest in a stock which will see its value increased in the future before its price actually grows; instead, they tend to follow momentum and jump on trends when already half the battle is done, incurring in higher buying prices and lower selling prices overall.

Moreover, another of the ways to assess market performance is by looking at transaction costs because they are responsible for changes in net gains or losses and stock prices. Barber and Odean

(2000) observed that retail investors gain less than the market average at the net of their earnings: while gross returns were calculated to be 18.2% of the investment, after the deduction of commissions, they are found to decrease by 1.5 percentage points. (22)
Commissions are simply the price retail investors pay to brokers for the service they provide; those costs include both the brokers' accomplishments on the market on behalf of the trader and the potential financial advice they may give. Commissions are usually much higher for individual investors and they eventually wear down individual investors' profits by an appreciably greater amount compared to institutional investors, who are virtually not subject to such transaction costs.

3.4 Betting Against Individual Investors

While it's true that institutional investors are not exempt from poor investment performances (the human psychology can negatively affect any type of investor), this paper's purpose is not to analyze retail and institutional investors separately, but rather to prove that individual investors are not able to outperform the market on a sustained basis. Different studies show how individual investors cannot compete with institutions, as the latter show relatively superior performances, in matter of both earnings and levels of rationality.

Institutional investors, in fact, did not seem to display the same overreaction that affected individual investors. Despite the extensive losses suffered, many institutional investors continued to hold the line against retail investors: in fact, contrary to popular belief, not all shorters were forced to retreat, many kept their short positions open, as demonstrated by data on the percentage of GME's float shorted.

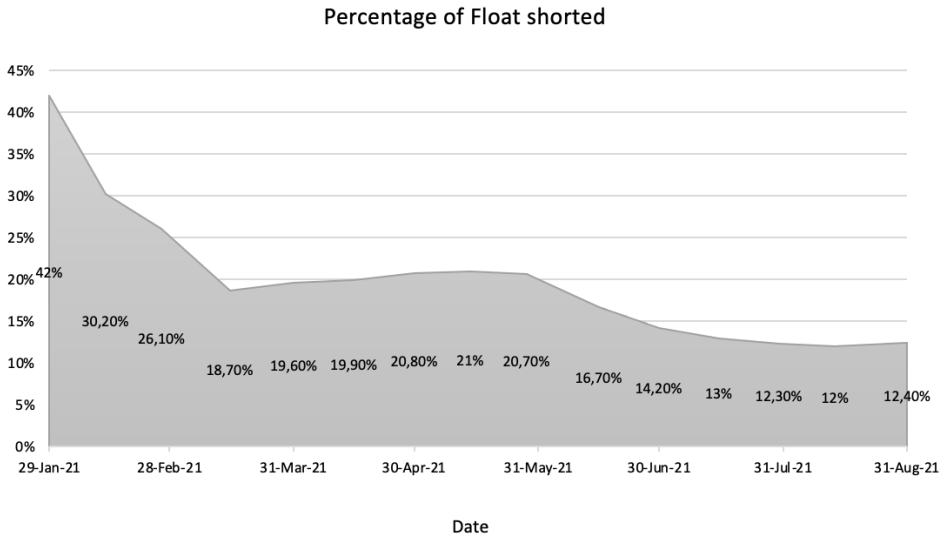

Figure 5: Percentage of GME float shorted.

Since February 29th, the number of short positions certainly declined, but not as abruptly as retail investors had imagined. During February through May, the percentage of shorted shares was approximately nineteen percent, and did not fall below fifteen percent until the end of June[21]. We hypothesize there may be a two-way explanation for this phenomenon: in a certain degree it lends credence to modern behavioral theories on investor irrationality, yet it is reasonable to believe that, to some extent, institutional investors are in fact more rational compared to retail investors because of their proven expertise, more efficient predictive methods and easier access to information.

Disposition effect vs…

Some of these investors may have been biased by what Shefrin and Statman (1984) defined as "disposition effect": the common inclination towards holding assets which have decreased in value because of investors' reluctance to incur losses, also known as "loss aversion". In their study, Shefrin and Statman pointed out that investors often fail to realize losses and prefer to "*ride losers*"[22] in their portfolios in the hope for better times. The underlying motivation is that, typically, an investment is made taking a certain "reference" amount as a benchmark to measure possible gains and losses, and, in general, investors enter into financial transactions with the prospect of making money rather than losing it; these two elements, combined with loss aversion (which is not the same as the goal of profit: one would rather reach the breakeven point without making any profit than realizing a loss), cause investors not to sell undervalued assets. (24)

Of course, if this bias affects informed investors, it must be the case for inexperienced investors as well. Data shows that numerous retail investors who had ventured in long positions in GME shares lost considerable amounts of money during the first days of February after the sudden price drop that caused GameStop shares to lose up to eighty percent of their value[23]. This goes to show that, however biased institutional investors and hedge funds may be, they are far more acquainted with the functioning of financial markets than retail investors that tried to destabilize them. A natural question arises: what if the decision of holding short positions was actually the result of a somehow analytical reasoning?

[21] https://www.marketbeat.com/stocks/NYSE/GME/short-interest/

[22] Shefrin H., Statman M. *The Disposition to Sell Winners Too Early and Ride Losers Too Long: Theory and Evidence*. Dallas: The Journal of Finance, vol. 40, issue 3, Papers and Proceedings of the Forty-Third Annual Meeting American Finance Association; 1984.

[23] https://en.wikipedia.org/wiki/GameStop_short_squeeze

Many economists, among whom Friedman (1953) and Fama (1965), argue that the noise created by such retail traders is negligible when analyzing the paths of stock prices, or better, it is to be taken into account only when analyzing its short- run effects (such as the excess volatility discussed above, for example). In fact, the tendency for stock prices is to revert back to their fundamental values, that is, in the long run prices are much less affected by their short-run market value, contrarily, they are the result of stock fundamentals, namely cash flows, asset returns, debt-to-equity ratio, just to name a few. (10)

This means that their intrinsic value is reflected by endogenous factors rather than external temporary influences of asset supply and demand, therefore the effect on prices of such destabilizing factors are short-lived. This hypothesis has the strong rationale that more rational investors will eventually bet against noise traders, driving prices to their normal levels, and leading individual investors to withdraw from their trading activity.

3.4.1 Market Selection

In this matter, Alchian's "natural selection" approach brings forth an interesting analogy that can aid the explanation of why institutional investors may be better off on the whole compared to retail investors and that they can counteract their trading activity. Retracing Darwin's steps, he elaborates on the concept of "survival of the fittest" in economic terms, associating the economic environment to nature, and its actors to animal species, coming to the conclusion that investors are no different when it comes to surviving in their environment: those who embody more appropriate characteristics (examples may be the ability to make accurate predictions, the skillful use of financial tools, the aptitude not to be excessively influenced by psychological biases…), are able to adapt and thus survive in the market, whereas individuals that do not have such prerequisites are eventually forced to exit the market. Those characteristics need not to include perfect profit-maximizing rationality, then again, the hypothesis of "*homo oeconomicus*" does not hold in modern economic studies, what counts is the ability to make positive profits, and, since in financial markets there are either winners or losers, in the long run, those who cannot sustainably make gains are outclassed by more rational investors. (25)

4. Conclusion

Overall, despite the considerable amount of risk brought about by retail investors and the threat that their presence might presently rearrange market dynamics, it is safe to say that financial markets will continue to function relatively efficiently.

Many studies have found that retail investing activity puts destabilizing pressure on financial markets for various reasons. Behavioral tendencies like herding and the likeliness to be persuaded by surroundings already in themselves have the effect of weighing down the entity of market shocks caused by individual investors; if we throw in the wide-spread availability of technology, the possibility to communicate and exchange information emphasizes even more their impact on market constituents. Retail investors, especially those who show particular enthusiasm for investing fads, are proven to cause the majority of the variations that financial markets experience in the short run, namely stock price volatility, which increases investment risk, and changes in trading volumes, which affect supply and demand equilibria, and may jeopardize overall market stability.

However, these risks are deemed to be short-lived, meaning that market shocks created by individual investors do not affect long run trends, and are bound to fade in very short periods of time. Despite the fact that trading activity by individual investors may, in few cases, lead them to outperform the market, their above-average earnings are not founded on solid grounds, but rather, are the result of luck or chance. Indeed, individuals' investment decisions are not the result of pondered reasonings, instead, their complete lack of economic rationality causes their behavior to reflect important psychological biases: for instance, overreacting to sudden changes in the environment or the lack of resilience when faced with losses are just some examples of why individual investors are not able to outperform the market on a sustained basis.

This goes to say that their initial enthusiasm towards trading and the thrill they get after considerable (but episodic) gains do not last long enough to represent a long term threat. Moreover, when retail investors are met by institutional ones, their ill-advised investment decisions are generally counteracted by institutional investors, which eventually results in a poor market performance.

The fundamental reason why we assume that institutions and hedge funds exceed in performance compared to retail investors is that the former does not exhibit irrational behavior as much, as well as being facilitated by insignificant transaction costs and superior knowledge about the financial environment. This gives them relative advantage compared to individuals, who cannot sustainably compete against institutions and sooner or later, are bound to exit the market.

On a final note, however the dynamics may change, financial markets will always be able to adapt to the new circumstances; what is certain, is that it requires brilliant minds to carry the financial machine forward, and to ensure its methodical functioning.

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