# From Lambs to Lions: How did Retail Investors' Role and Trading Behavior Change in the Light of WallStreetBets?

Bachelor Thesis

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Frankfurt am Main, 01 August 2021

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## II. Abbreviations

| | |
|---|---|
| cf. | conferatur |
| COVID-19 | Coronavirus disease 2019 |
| e.g. | exempli gratia |
| et al. | et alii |
| FINRA | Financial Industry Regulatory Authority |
| GFC | Great Financial Crisis (of 2007-2009) |
| i.e. | id est |
| IAC | Investor Advisory Committee |
| OCIE | Office of Compliance Inspections and Examinations |
| OIA | Office of the Investor Advocate |
| OIEA | Office of Investor Education and Advocacy |
| OTC | Over-the-counter |
| SEC | United States Securities and Exchange Commission |
| SVI | Search Volume Index |
| US | United States of America |
| w.r.t. | with regards to |

## III. Figures

# 1. Introduction

Over the course of the last financial crises, retail investors have been identified to bear a major share of the invoked financial losses (The Financial Crisis Inquiry Commission, 2011). As a consequence, financial market regulators put major effort on retail investor protection, especially following the Great Financial Crisis (GFC) of 2007-2009 (SEC, 2014a; SEC, 2019). The major legislative initiatives, such as in the Dodd-Frank Act in the United States (US), seemingly manifest retail investors' overly fragile role among the variety of professional investors in the financial market by establishing additional protection requirements for retail investors. A vast majority of related international academic literature is supporting those steps, highlighting retail investors' proneness towards e.g. financial risk misjudgment (Barber and Odean, 2013), overconfidence (Odean, 1999) or their tendency towards overreactions (Hirshleifer et al., 1998). However, considering the most recent developments that occurred in the US financial markets, the dogma of the lamb-like retail investor seems to be crumbling: In 2021, under the synonym "WallStreetBets"[1] retail investors systematically colluded in investment bets which eventually disrupted not only financial markets by distorting stock price formation of single firms but also systematically squeezed sizeable positions of institutional investors.

The key question arises, how retail investors have changed, such that they not only became a source of price distortions and market turmoil but also endanger professional institutional investors. Understanding this transformation and the respective underlying drivers and enabling factors does not only provide vital input for future regulation and policy makers but also opens up new fields of future academic research.

In this thesis, I study this changing role and investment behavior of retail investors. For this purpose, chapter 2 provides fundamentals relevant for subsequent chapters, such as a general definition of the retail investor. Chapter 3 then links the retail investor's well-established and researched behavioral characteristics to the changing environmental aspects such as regulation and the adaption and usage of technology for information gathering and collaboration. Based on the combination of those different research streams, I am able to deduct the sequential consequences of these developments for

[1] The pronunciation of "WallStreetBets" is derived from the Reddit forum r/WallStreetBets, in which retail investors colluded on potential targets for stock investments and strategies.

financial markets in chapter 4. In chapter 5, I will critically review the developments highlighted in the previous chapters, provide an outlook based on the current discussion in the aftermath of WallStreetBets and critically review the limitations of this thesis. Finally, in chapter 6, I will conclude and summarize the major drivers that changed the balance of powers to answer the central research question of this thesis: How did the role and investment behavior of retail investors change over the last years, and especially in the light of WallStreetBets?

To put the developments with regards to retail investors' role and behavior into a timely context, two reference points are defined: As a starting point, the GFC of 2007-2009 is being referred to, since it left many retail investors with major financial losses after being the pawn in the hands of the powerful forces in the financial sector. The current state of play is resembled by the WallStreetBets events of early 2021, until which market dynamics and powers seemingly had changed in the favor of retail investors, and large institutional investors seemed to be the pawn in the hands of an aggregate of individuals. Besides this timely scope, the jurisdictional scope for the thesis is limited to the United States (US), since for both above-mentioned examples, the root causes originated in the US and the most seismic repercussions could be observed in the US.

## 2. Background information

In this chapter, key fundamentals relevant for the understanding of the subsequent chapters shall be defined and explained. After a clear delimitation of the term "retail investor", the chapter briefly outlines what happened during the WallStreetBets episode of early 2021.

### 2.1 Characteristics of retail investors

A retail or individual investor is defined as "a natural person, or the legal representative of such natural person, who seeks to receive or receives [financial] services primarily for personal, family or household purposes" (SEC, 2021). Hence, retail investors engage on financial markets on their own accounts but need to execute their trades through retail specialized or online brokerage firms providing access to the market as well as supplementary trading services. Further, retail investors often make use of financial

advisors, since they are equipped with less time, and (cognitive) resources than institutional investors (Bhattacharya et al., 2012). They are found to be non-professional investors who normally trade smaller volumes than institutional investors (Hackethal et al., 2017). Moreover, a large number of academic studies find retail investors being associated with uninformed decision making which results in systematic mistakes when selecting investments and subsequent underperformance (Barber and Odean, 2013).
Retail investors' overall relevance for and impact on the financial markets is ambiguous. As of today, no exact numbers exist, as there is no dedicated identification possibility on trade execution or position level that may allow insights, instead, several non-academic estimations are available. Citadel Securities (a prominent execution partner for retail flow from broker-dealers) states that retail investors have accounted for as much as 25% of the stock market's activity amid coronavirus-driven volatility (Basak, 2020). Similarly, Bloomberg (Tabb, 2021) concludes that in 2021, retail investors account for 23% of US equity trading volume, in contrast, all institutional buy-side firms (such as pension and investment funds) account for 27% of the volume. Both estimations are barely verifiable and must be considered carefully, nevertheless, retailers represent a significant and growing amount of US liquidity.

## 2.2 The WallStreetBets episode of early 2021

A recent event, namely the WallStreetBets episode, which took place between 28 January 2021 and early February 2021, displayed a formerly unseen kind of retail investor behavior. A large group of individual investors colluded online via the Reddit forum "r/WallStreetBets", coordinating a series of trades in an effort to affect the positions of large hedge funds, who had massively shorted a number of stocks which can all be categorized as less liquid, enabling the swarm of induvial investors to impact the stock price by low financial power on an individual basis. By entering long positions, the Redditors initiated a so-called "short squeeze" of the stocks in focus – overrunning the hedge funds who had bet against these firms and who were unaware of this effort. Due to massive price increases, they were forced to close their short positions at losses in the billions of dollars. Figure 1 depicts the stock price development and respective trading volumes of GameStop Corp., one of the first stocks targeted by the WallStreetBets community by end of January 2021.

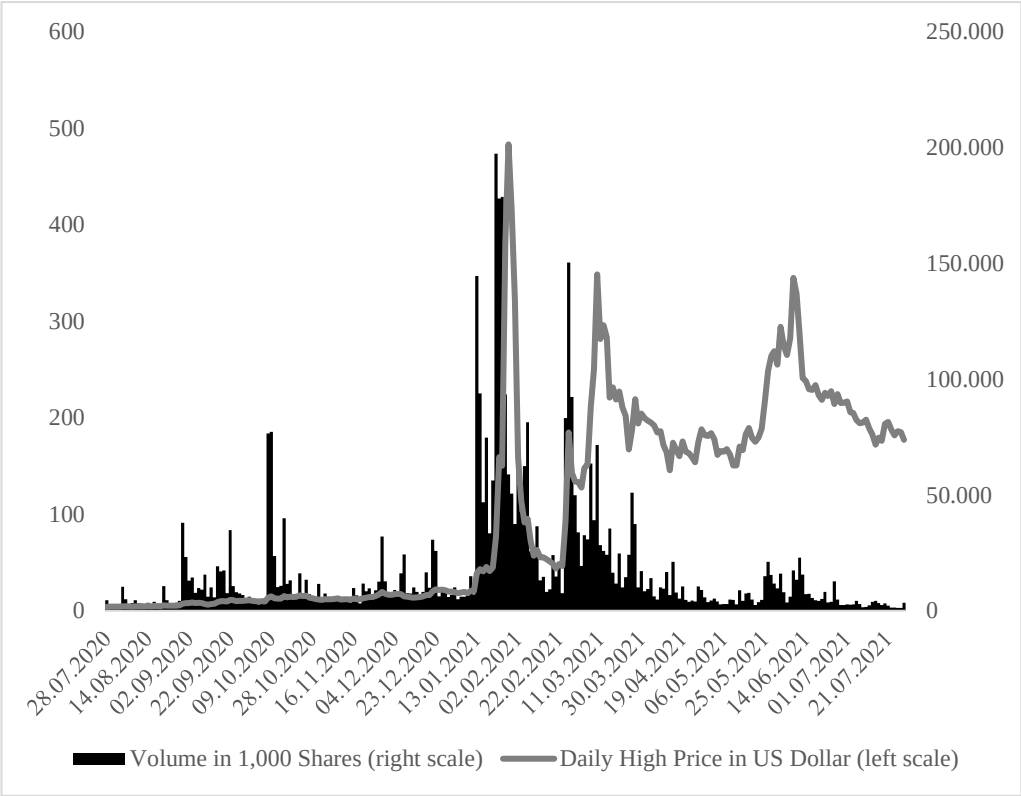


Figure 1: Trading volumes and stock price development of the GameStop Corp. stock traded at New York Stock Exchange during July 2020 and July 2021.

Even though prices reverted back shortly after the episode, even the temporal price surge left institutional investors in shock at the massive losses invoked.

Further, it exhibited new features in the role of individual investors in equity markets: They push trading volumes, use leverage and derivatives to speculate and social media tools such as Reddit for information gathering and collusion. So, from the GFC on the one hand and the WallStreetBets episode on the other hand – how can ends be met when it comes to retail investors' role and trading behavior on financial markets?

## 3. Analysis: behavior, regulation, and informational environment of retail investors

To make ends meet between retail investors' role and trading behavior in times of the GFC and the observations from the WallStreetBets episode, this chapter analyzes three key aspects perceived to be the most influential in this context: Behavioral biases as a persisting aspect on the one hand, which seem to put retail investors at a disadvantage,

and regulatory as well as informational aspects on the other hand, which led to substantial changes in their environment that seemingly compensated at least some of these disadvantages in between the two reference events.

## 3.1 Behavioral aspects

The proneness of retail investors to behavioral biases can in principle be derived from their limitations in time and cognitive resources. They consciously or subconsciously break down complex sets of information to a few key facts, and approach investment decisions upon a much smaller set of information than sophisticated investors (Sutton et al., 2009). Confident in their heuristics, which are often prone to human errors or wrong in nature, retail investors tend to underlie a variety of behavioral biases when judging or deciding on an investment.

This subchapter elaborates on such behavioral biases on the individual retail investor level, how they transpose to the aggregate level of retail investors and the implications they have for retail investors in general.

### 3.1.1 Individual biases of judgement and decision: most prevalent observations

This subchapter provides an overview on the most prevalent observations of behavioral biases when it comes to judgement and decision regarding security valuation and selection. Those behaviors are detrimental to retail investors' portfolio returns, and thus, put them at a disadvantage compared to more sophisticated investors. Focus rests on the individual retail investor level considering overconfidence, the extent of attention directed to investment decisions as well as emotions, mood and self-control.

Overconfidence for people in general, i.e. an overestimation of a person's abilities, is emphasized by a comprehensive body of evidence in psychology (Odean, 1999). Barber and Odean (2013) distinguish between two forms of overconfidence. They describe the first form of overconfidence as the "belief that one knows more than one actually does". They refer to this as "miscalibration" or "overprecision", as people typically provide confidence intervals which contain less correct answers than anticipated in their studies. Translated into the context of investing on financial markets, this would mean that retail investors overestimate their security valuation ability, which implies that

they underestimate their forecast error variance. They describe the second form of overconfidence as the "belief that one is better than the average person". They refer to this as the "better-than-average effect", which also captures "biased self-attribution", i.e., the tendency that investor confidence changes based on portfolio return outcomes. Similarly, Hirshleifer et al. (1998) establish that investor confidence increases when public information confirms own information, but it decreases less in magnitude when public information contradicts own information. Empirical evidence indicates that both varieties of overconfidence are correlated with excessive trading activity from retail investors (Graham and Dodd, 2009). Whereas the better-than-average and biased self-attribution variety of overconfidence provides some clear conjunctions (Hirshleifer et al., 1998), the evidence for the miscalibration variety to cause higher trading activity is weaker. Barber and Odean (2013) suggest this might be due to the inability to measure miscalibration well. Also, the bias seems to be self-enforcing: This suggests that (self-perceived) experts, i.e. investors who trade frequently, tend to be more overconfident than relatively inexperienced individuals – and in turn exhibit increased trading frequencies due to higher levels of overconfidence, which again contribute to their expertise and make them even more overconfident (Griffin et al., 1992). Besides differences in investors' cognitive capabilities, the notion of overconfidence explains why investors equipped with identical information dissent so much, particularly on stock prices, and why investors who neglect important information would nevertheless trade too much and to their detriment.

Attention devoted to investment decisions varies among individual investors with their limitations in cognitive resources. Barber and Odean (2013) argue that the extent of attention devoted to investment decisions can affect retail investors' trading behavior in two different ways: Too little attention paid to relevant information may induce an underreaction to such information, whereas too much attention paid to (also immaterial and misleading) information may induce an overreaction to such information. Concerning investor underreaction, academic literature indicates that investors miss important information when being distracted during their research. For example, Hirshleifer et al. (2009) find that investor reaction to a pre-earnings announcement (i.e. a surprise) is less pronounced than to a post-earnings announcement (i.e. something expectable) for firms announcing earnings on common announcement days. They suppose that this is due to the multitude of firms vying for investors' attention on such days. Considering investor overreaction, Barber and Odean (2013) find that instead of conducting systematic

research, retail investors rather pay attention to catchy stocks which attract them the most, e.g. stocks with large media coverage or stocks with greater recent volatility. This makes them overly buy (or sell) such stocks, especially when buying or selling is perceived as a chance event. To measure retail investor attention and to predict implications to financial markets, a variety of studies has been undertaken till date. For example, Da et al. (2010) use Google searches as a proxy for retail investor attention and show that surges in the frequency of Google searches on a daily basis are followed by higher retail investor trading activity during the subsequent two weeks and a reversal during the subsequent year. On a more granular level, Meshcheryakov and Winters (2020) use hourly Google searches as a proxy for retail investor attention to show that the latter affects trading activity and perceived informativeness of retail investors. They document that increases in Google searches w.r.t. to the stocks in focus predict intensified retail investor trading during the next hour in those stocks. Further, they suggest that Google researches do not contribute to retail investors' true informativeness, but rather make them perceive themselves as informed and to engage in "noise trading", by mistaking noise for information. Meshcheryakov and Winters (2020) also suppose that this effect is endorsed by truly informed traders, who intentionally trade against such orders and benefit at the expense of the retail investors who are led by their selective attention.

Emotions, mood, and self-control also matter in such conventionally rational decisions as time and risk preference and are being displayed in a variety of forms. An example w.r.t. emotions impairing rational decisions is that individual investors seem to have a distaste for ambiguity. Hirshleifer et al. (2009) explain this with the fact that decisions are often perceived as gambles besides the given probability distribution of outcomes. Suggested by the Ellsberg paradoxes (Ellsberg, 1961) and confirmed by experiments, people are averse to such uncertainty as imposed by gambles and this causes them to make irrational decisions. This evidence possibly reveals an overall impact of emotions such as fear on decisions with (perceived) gamble-like features. Hirshleifer et al. (2009) hypothesize that ambiguity aversion can be explained by the absence of one or more concrete parameters in the decision problem. They suggest that this is associated with gambling and increased risk, which again, is associated with fear. Another example refers moods impacting decision making and risk taking. Particularly, people in a good mood are more optimistic in their predictions and decisions than people in bad moods (Wright et al., 1992). Mood also influences people's risk attitudes (Mann, 1992): Bad moods imply a more comprehensive and critical evaluation of information (Petty et al., 1991). A final example

is inconsistent time preference as a form of bounded self-control. In theory, time inconsistency in preferences does not exist. Though, Hirshleifer et al. (2009) propose that in practice, time preference varies, depending on given conditions. They argue that a deferral of consumption implies self-control and consequently, is linked to mood and emotions. Particularly, they suggest that people are more likely to accept deferrals, the further away the consumption date is, but the closer it approaches, the less likely it is that they will accept a deferral of consumption. This phenomenon has been labelled "hyperbolic discounting" and causes decision reversals even without new information (Ainslie, 1975).

### 3.1.2 Resulting effects on the aggregate level of retail investors

The behavioral biases on individual level described in subchapter 3.1.1 can be amplified by social interaction among individual retail investors. Therefore, the resulting effects on the aggregate level of individuals must be considered as well. This subchapter elaborates on a few of these effects, specifically on those which seemingly matter the most for the context of this thesis.

Sentiment reflects the general tenor of retail investors w.r.t. a certain stock or a market. Rising prices indicate bullish market sentiment, while falling prices indicate bearish market sentiment. It is derived from trading activity and price movements of the stock or market in question, which again can often be deduced from investor attention and emotions. Therefore, sentiment can vastly differ from rationale, i.e. the fundamentals of a stock or a whole market, which represent its plain performance, based on technical analysis. Several studies document that, unlike institutional investors, retail investors often fail to use value-relevant information (e.g., Lee, 1992; Hirshleifer et al., 2009; Maines and Hand, 1996; Blankespoor et al., 2018) even if this information is disseminated via publicly available news releases (Drake et al., 2017). Instead, retail trading activity is often correlated with sentiment, which regularly comes and goes in waves: Positive sentiment (i.e. bullishness) leads to excessive risk taking and trading activity, which is repeatedly followed by a crash or recession, leading to negative sentiment (i.e. bearishness) and to retail investors shying away from financial markets, at least temporarily. Somewhat later, when those investors have regained (over-) confidence, and past losses have faded in their minds, the exact same happens again. This suggests that they do not learn from mistakes made earlier and that they do not

permanently adjust their risk appetite. Rather, they seem to be drawn back to the market again by positive sentiment. Especially risk-affine investors seem go back rather earlier than later (if they did not stay during the recession). Generally, sentiment makes investors follow (or oppose) the current trend observed in a stock or market and can thus be linked to both – herding and (temporal) contrarian behavior, certainly however, it is a key trigger for retail investor trading activity.

Herding behavior was first defined by Lakonishok et al. (1992) as "buying (selling) simultaneously the same stocks as others buy (sell)" but the definition can be extended to all kinds of assets. Burghardt (2011) divides herding as described above in two dimensions: selection of time and selection of assets. His time-dimension refers to multiple retail investors buying (selling) at a market at the same time which is also called market-level herding. His asset-dimension refers to multiple retail investors selecting the same stocks at the same time which is also called stock-level herding. Burghardt (2011) summarizes the body of evidence on herding behavior: For the market level, he confirms herding behavior of retail investors, since about 60%[2] of retail trading volume is constantly on the same side of the market each day. For the stock level, he measures a similar magnitude of herding as retail investors herd into and out of the same stocks at the same time. Further, it needs to be distinguished between rational herding and psychological herding. While rational herding is a reasonable way to act on financial markets, psychological herding is not. In literature, three possible explanations for psychological herding exist. First, the contagion theory supposes that in a mass, people are much faster affected by emotions, which prohibits rational decision-making (Snow, 2013). Second, the convergence theory assumes that "similar" individuals join to a group or mass, which activates existing "similar" behavioral patterns (Snow and Rohlinger, 2013). Third, the emergent-norm theory suggests that collective behavior is being induced by a context-related norm, which leads to identical directed actions (Lemonik-Arthur, 2013).

Contrarian behavior would imply an opposing behavior to herds – consequently, the opposite question to herding behavior is whether individual investors behave as

[2] Burghardt (2011) uses a data set of retail investor order flow in DAX derivatives at Boerse Stuttgart and constructs a measure of retail investor herding. He finds that on average 60.3% of all retail trading volume is on the same side of the market in observed time periods, which is 10,3% more than the equal random distribution of 50% optimistic and 50% pessimistic volume, which would have negated the assumption of herding behavior.
German data is referred to, since comparable US measures do not exclusively consist of retail orders. Instead, they entail all orders executed on an exchange, such as NYSE or NASDAQ.

contrarians. According to Barber and Odean (2013), a contrarian investor trades against the contemporary tenor, e.g. by shorting a company's shares when their price increases. This would mean, that an investor acts contrarious by principle. However, this is incompatible with the basic economic assumption that individual investors seek profit maximization. Thus, Barber and Odean (2013) argue that individual investors are not contrarians by principle. Contrarian behavior might only then be assumed, when investors temporarily oppose the overall tone in the market, because they (mis-)believe that this might be a rewarding strategy. Hence, temporal contrarian behavior is assumed to result from overconfidence, in this case, the perception that one has found a rewarding strategy that others do not see.

### 3.1.3 Behavioral implications for retail investors

The behavioral biases of retail investors found on the individual level lead to specific patterns on the group level with major implications on retail investors' trading activity, which can also explain some of the behavior seen during the WallStreetBets episode in early 2021. A key component of the WallStreetBets episode were specific hype advertisements through the underlying Reddit forum which resulted in a bullish sentiment among and repeated herding behavior of retail investors w.r.t. the stocks in focus. This behavior was pioneered by contrarian strategies that focused on high-risk investment into specifically chosen illiquid stocks. The more retailers were hyped by this "courage", the more entered long positions and a "herd of contrarians" seemed to trade against the institutional investors. The sentiment in these stocks then flipped upside down, from bearishness to bullishness, just within days.

Also, given the initial success of these investment schemes, retail investors continued and copied this behavior in order to repeat the success and further profit from the established strategy. Empirical studies have labeled this observation "reinforcement learning" and further concretized it: Amongst others, Malmendier and Nagel (2011) suggest that individual investors learn through reinforcement, i.e. repeat behaviors that previously resulted in favorable outcomes and avoid those that resulted in unfavorable outcomes. They find that investors who have previously witnessed high stock market returns are more risk-affine and more likely to invest in stocks and that the opposite holds true for investors who have witnessed heavy recessions, such as the GFC. This would imply that retail investors also adjust their risk appetite based on experience and observations.

## 3.2 Regulatory aspects

Legislative has broadly recognized the disadvantages retail investors are exposed to w.r.t. own limits in cognition and following (mis-)beliefs. Consequently, major efforts concentrated on counterbalancing the situation for them, especially since the GFC. The most influential regulation entering into force afterwards was the Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010 (hereafter referred to as Dodd-Frank Act). It introduced measures designed to regulate the activities of the financial sector, to protect consumers and enabled the creation of new oversight committees and increased the power given to existing ones, primarily the US Securities and Exchange Commission (SEC).
This subchapter is divided into the major problems identified as harmful for retail investors in the aftermath of the GFC and how they were addressed by the Dodd-Frank Act and some efforts going beyond its provisions.

### 3.2.1 Protection of retail investors

Title IX of the Dodd-Frank Act is dedicated to "Investor protection and improvements to the regulation of securities". Its Subtitle A is well-known and cited as the "Investor Protection and Securities Reform Act of 2010". Some of its provisions were concretized at a later stage in the "Retail Investor Protection Act of 2013". The main reforms with regards to retail investor protection included were assigned to the SEC as the responsible regulator and can be summarized as follows: First, an independent Investor Advisory Committee (IAC) was established at the SEC, tasked to support rulemaking efforts for protecting individual investors and their interests. Second, an Office of the Investor Advocate (OIA) including an ombudsman for investors was established at the SEC, mandated to analyze the impact of the SEC's rules on retail investors and areas for improvements in favor of retail investors. Third, the SEC's Office of Compliance Inspections and Examinations (OCIE) was created to conduct studies and regular reviews to further specify rulemaking on obligations of brokers, dealers, and investment advisers (cf. subchapter 3.2.2) and financial literacy among investors (cf. chapter 3.3.3). Until today, the OCIE has broadened its examination areas to all those who generally bear risk of harming retail investors and firms whose characteristics may reflect an increased risk to retail investors.

### 3.2.2 Integrity of financial advisers and intermediaries serving retail investors

Title IX, Subtitle A of the Dodd-Frank Act also responded to the broad-ranging problem of financial services intermediaries not serving retail clients properly and with full integrity. The SEC's Office of Investor Education and Advocacy (OIEA) transposed the provisions within into a uniform fiduciary standard and common rules for broker-dealers and investment advisers. Since adoption by the US congress, these rules are known as the "Retail Investor Protection Act of 2013". The bill mainly encompasses provisions on disclosure obligations and codes of conduct for broker-dealers and investment advisers serving retail clients, to ensure that investment advice is "suitable for the customer". Further it enhances existing rules on the custody of customer funds and a broad-based initiative to improve the regime on public disclosure of conflicts of interest as well as some legally binding standards on accountability and corporate governance (i.e. compliance culture). By obliging these financial service providers on rules, standards, and codes of conduct, all of these provisions aimed to enhance the transparency and integrity of financial advisors and intermediaries which serve retail investors.

### 3.2.3 Transparency regimes for institutional investors

The failure of the financial industry to fully disclose the risk exposures inherited in the financial system suggests that a significant problem that contributed to the seismic magnitude of the GFC was the lack of transparency. This lack allowed financial risks to build up and be transmitted across different institutions and even sectors. Thus, among the major changes to be introduced with the Dodd-Frank Act were transparency requirements for Over-the-Counter (OTC) derivatives transactions and central clearing requirements for complex and non-standardized financial products as well as the need to trade such products at regulated markets and exchanges (which again were obliged to facilitate position and transaction reporting). The intention behind these provisions was to reduce the complex interconnections between institutional investors and make their risk positions transparent. In conjunction with this, extensive transparency regimes for institutional investors of all kinds were introduced. Especially hedge funds and private funds are since subject to extensive recordkeeping requirements and disclosure

obligations. Among the most controversially discussed topic on transparency was the requirement to openly disclose short positions. An investor builds up a short position by borrowing assets and selling them in order to profit from falling future asset prices. Major short sellers are hedge funds and proprietary trading investment firms.

The SEC conducted studies on efforts and benefits of short selling disclosure requirements and concluded to gather and publicly release daily aggregated data on short sale positions reported to Financial Industry Regulatory Authority (FINRA) since 2014. Although no information on the identity of the respective short seller is available, the data aggregates overall positions for every firm and security traded at the major US exchanges and OTC (SEC, 2014b). A variety of internet platforms utilize this data to compute local and global short interest indexes or indicators available also to retail investors.

### 3.2.4. Regulatory implications for retail investors

The regulatory requirements brought forward in the aftermath of the GFC fostered retail investor protection in manifold ways, e.g. by strengthening service requirements and information disclosure directed towards them. However, with additional transparency requirements for institutional investors, not only the regulator gained additional insights into risk positionings and interaction among financial institutions, also interested retail investors may acquire additional information and enrich their investment decision making, such as it happened prior to and during the WallStreetBets episode in early 2021 when investors specifically targeted stocks with high overall short selling positions.

## 3.3 Informational aspects

Over the last decade, a growing number of technological innovations has led to substantial changes in financial markets. These developments bring a huge set of new possibilities to retail investors, but also inherit some difficulties, which they have to cope with.

This subchapter summarizes the major technological and informational aspects which have contributed to the transformation of the retail investors' trading environment.

### 3.3.1 New trading technologies and reduced transaction costs

Barber and Odean (2001) summarize that the internet has reduced the overall costs of providing financial services, which enabled new providers of such services to challenge established ones. Some of these new online retail brokers back then were Charles Schwab and Ameritrade who started to provide online financial advice, research tools, and financial information to individual investors. These firms have transformed the way traditional services were delivered, provided many new services, and paved the way for further developments in the sector of retail investor advisory and trading. Since approximately five years from now, these well-established brokers are challenged by so-called neobrokers such as Robinhood and Webull. Like the traditional ones, neobrokers are online retail brokers but their infrastructure allows investors to trade stocks and partially derivatives with a depot account that they manage with an app. Neobrokers concentrate on providing trading infrastructure only, since most retail investors are nowadays rather getting informed by themselves (e.g. via Google searches, cf. subchapter 3.1.2) than paying for financial advice. This development makes one-stop-shop business models comprising financial advice, research tools and financial information too expensive, if not obsolete at all for many retail investors. The overall trading costs via neobrokers are negligible or not existing as they receive compensations from the respective execution partners – typically hedge funds or high-frequency traders – who, in turn, execute this flow in their capacity as a market maker at a fixed trading venue. Trading venues have incentive schemes in place, which reward this liquidity provision with fee rebates for the market makers' proprietary trading flow. This practice is called payment for order flow and has attracted many new investors, who had earlier been deterred by expensive trading commissions.

### 3.3.2 Lower cost of information and new research channels

The recent increases in retail investor flow also echo that costs of information for shares, in which retail investors are mainly active, have shrunk negligible levels due to technological innovation. A decade ago, only institutional investors with financial resources and capabilities to retrieve and process such information, could benefit from this shrinkage, but now, retail investors are included. Democratizing information dissemination is promising: More people will be able to gain access to markets cheaply,

so that liquidity will be injected even into the most illiquid assets. The consequence is an (already observable) expansion of financial markets, as more and more different kinds of cash flows become securitized.

At the same time, financial information flows are being disaggregated. Financial news used to come from superficial TV and newspaper reports. Today, real-time data from tracking indices and sensors amongst other web-based sources is available to everyone. And such data is available in various levels of aggregation, to fit every retail investor's needs and capabilities to digest financial information.

Rickett and Datta (2016) argue that retail investment media has become widespread with the success of investment TV shows and the growing popularity of investment blogs, which both disseminate investment opinions and are already deemed part of "mainstream" retail investment media sources. Further academic studies show that retail investors perceive investment blogs as an important source of financial information and that financial markets respond to opinions disseminated on investment blogs (Antweiler and Frank, 2004; Das and Chen, 2007). Moreover, the growth of "infomediation" (i.e. the consumer-oriented free publication of evidenced knowledge), both online and offline, showed that particularly during uncertain economic periods, retail investors trust these financial information sources even more. A rather new financial information phenomenon is social media. Especially younger individuals seem to use social media as a source of financial information. However, it is to be regarded as a platform for opinions but not for objective and substantial investment advice. Posts on online forums merely represent chatter about past volatility, rather than anticipating future trends. Nevertheless, social media can also be (mis-)used for collusion, since it is neither supervised nor regulated, and thus offers individuals many possibilities to influence each other or to join forces.

### 3.3.3 Financial literacy versus gamification of trading

Zokaityte (2016) claims that calls from regulators and organizations to improve consumer protection in financial markets by demanding increased firm and trading data disclosures would only swamp retail investors with data, but not help understanding the data and thus, be an illusion of transparency. She argues that extensive studies on financial literacy and numeracy demonstrate how financial illiteracy negatively affects the ability of consumers to understand disclosures and that this prevents consumers from undertaking proper analyses of financial information. She also documents that disclosures become ineffective

in the light of consumer unwillingness to engage in learning more about financial markets. Therefore, she emphasizes that investor protection cannot be pushed by enhanced transparency only, it needs to go hand in hand with efforts to improve individual investors' financial literacy.

The general trend observable on the agendas amongst governments, regulators, and associations follows such recommendations. Broad improvements to financial literacy are being pushed, e.g. through programs for investor education or intelligence made available online via websites (cf. subchapters 3.2.1 and 3.2.2 for efforts by the OCIE and OIEA). There are two aspects that are impairing this trend, which are depicted in figure 2: First, the swamp of immature investors lured to financial markets mostly by social media and the gamification of trading, so that activity in existing and new online brokerage accounts has spiked. Second, the COVID-19 pandemic, which has forced retail investors to stay at home during the lockdowns with reduced options to spend their paychecks and therefore started using them to day-trade. This day-trading often comes with much of attention and sentiment impulses to trade, but rather less involves fundamental analyses – especially when discovered by retail investors who are new to the market.

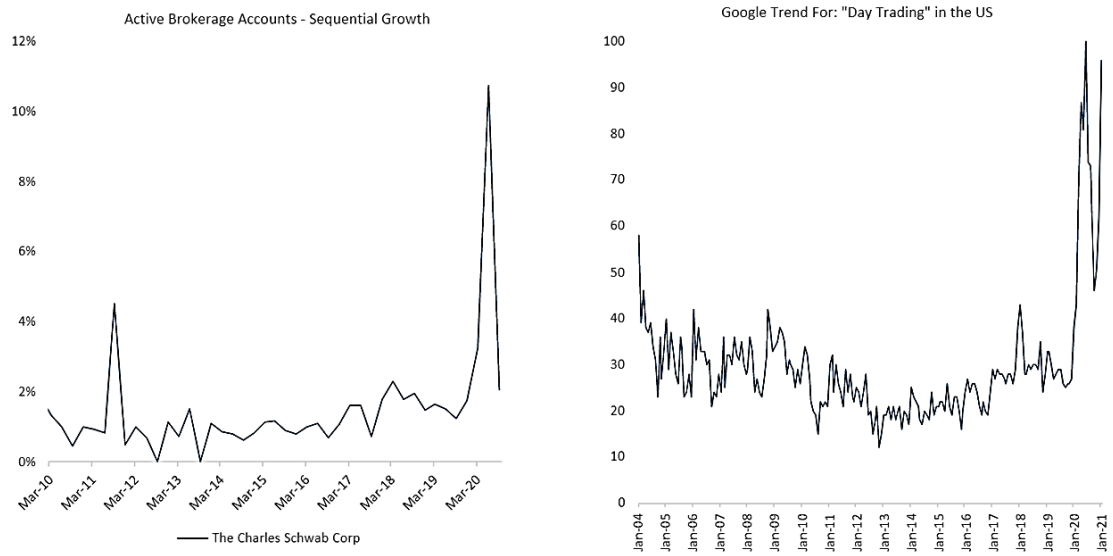


Figure 2: Simultaneous spikes in active brokerage accounts and interest in day trading

### 3.3.4. Informational implications for retail investors

With the decline in trading costs for retail investors, investing has become more widespread and additional service offering enabled retail investors to directly access a variety of products and execution channels relevant to act globally. Likewise, technology mitigated many of the disadvantages retail investors faced when interacting in financial markets, much of financial information is not any longer only available to professionals, overall costs of information are driven down to negligible levels and forums are used to discuss and collude on investment strategies. Additionally, efforts to promote financial literacy and numeracy among retail investors have become a priority for regulators and consumer protection organizations. The retail investors who participated in the WallStreetBets frenzy perfectly reflected these aspects, since they traded via neo-brokers, acted upon information from internet sources with volatile credibility and colluded via a social media forum.

## 4. Consequences for financial markets

While the chapter 3 summarized the key factors for retail investors to have changed not only individually but also as a group, it is vital to elaborate how this changed role and behavior affects financial markets as a whole – particularly under the conditions seen shortly before and during the WallStreetBets episode. Therefore, this chapter highlights the consequences for key metrics of financial markets, by elaborating on the targets, methods and impacts from retail investors on illiquid assets, collaborative trading patterns and price formation and how this logic was applied and stressed to the limits under WallStreetBets.

### 4.1 Targeting illiquidity

A stock's liquidity generally refers to the supply and demand in buying and selling of the stock. Liquid stocks are considered resilient, i.e., they experience high trading activity without substantial impact on the stock price and are also characterized by low transaction costs. On the contrary, in illiquid stocks, each single trade may potentially have a greater impact on the stock price due to the lack of other trading participants absorbing the impact of the trade. Illiquid stocks in general face a variety of frictions. Amihud and Mendelson

(1986) show that investors face higher transaction costs in less liquid markets which in turn must be compensated by higher expected returns, indicating the inefficiencies which come with illiquidity. This effect is declining only as the liquidity of a stock is increasing. Illiquid stocks are also more exposed towards market manipulation and inherit resulting stock price volatility. Aggrawal and Wu (2003) show that manipulators in illiquid stocks can capitalize on the greater dispersion in the market's estimate of the value of the stock such that there are less investors trading against this manipulation since the fair value of the stock is biased due to illiquidity.

In general, there is not particular evidence in academic literature that retail investors concentrate on illiquid stocks. On the contrary, highest retail shares can be found in liquid stocks (cf. subchapter 2.1). However, the stocks in focus during the WallStreetBets episode can all be categorized as less liquid which amplified the effects retail investors had on the liquidity level of the respective stock. After being advertised and discussed on social media platforms such as Reddit, attention from additional retail investors was drawn to these stocks. This attention was expressed in higher Google search frequencies[3] and a liquidity injection in form of retaliatory trades in the relevant securities (according to public data from MarketWatch).

## 4.2 Adaption of collaborative trading patterns

Given an illiquid stock or market, some trading phenomena are more likely to materialize. This subchapter focuses on two collaborative trading patterns, which are the most relevant for the context of this thesis: predatory trading and swarm trading.

Predatory trading appears to be the most aggressive form of collusion, which re-emerges under certain conditions, but it is observed rather rarely. According to Brunnermeier and Pedersen (2005), predatory trading can be understood as coordinated over- or undershooting of prices which induces and/or exploits the need of other investors to reduce or entirely step back from their positions. Given the right conditions, predatory trading can be a profitable strategy. To make this happen, they outline that markets must be illiquid so that prices can be impacted by larger trades shortly and that attacked traders must not be able to withstand unlimited losses. This implies that the more illiquid the

[3] Google search frequencies for GameStop Corp. stocks (exemplary for all stocks targeted by Redditors during the WallStreetBets episode) obtained from: https://trends.google.de/trends/explore?date=2021-01-01%202021-03-31&geo=US&q=gamestop

market and the longer the delay of distressed traders to reduce or net their positions, the more profit can be made at the expense of the attacked trader. Since the prey needs to be shared, predatory trading gets more profitable, the less predators are involved.

Swarm trading implies a weaker form of collusion, since many investors simply observe swarm behavior on a particular market and follow it hoping to make short-term profits. Swarm trading is observed more frequently than predatory trading since it does not require as particular market conditions as predatory trading does. However, stocks targeted by a swarm can usually be categorized as less liquid, enabling the swarm of retail investors to impact the stock price by low financial power on an individual basis. The bigger the swarm, the more liquid the stock which is about to be tackled can be to disturb orderly price formation. Further, swarm trading is usually more profitable for the individual within the swarm, the more they are (contrary to predatory trading).

Considering the WallStreetBets episode of early 2021, everything seems to have started with a few predators in illiquid stocks, deploying an overly aggressive, but internally aligned strategy in an effort to hunt down institutional investors' massive short positions and profit at their expense. The more retailers engaged in colluding and corresponding trading activities, the more attention these undertakings got, eventually resulting in a swarm, with predatory origins and with the professionals being driven into a corner, from which they could only escape amid substantial financial losses.

## 4.3 Impacting stock price formation

Hirshleifer et al. (1998) propose a theory for price formation in equity markets due to under- and overreactions based on the behavioral biases of overconfidence and biased self-attribution (cf. subchapter 3.1.1). Their theory implies that retail investors overreact to private information signals and underreact to public information signals due to these biases. Private information induces short-term momentum and long-term reversal effects, i.e. an overreaction to such signal right after arrival and a return to a normal, average price level somewhat subsequently. For public information, the effects are measurable as well, but weaker.

More importantly, Hirshleifer et al. (1998) also find evidence for short-term momentum and long-term-reversal in many security classes, for individual stocks and for the market as a whole. The evidence for short-term momentum comprises a positive short-lag autocorrelation of stock prices: Stocks that have done very well in the recent past tend to

do well over the next month. The evidence for long-term reversal comprises the finding that a negative short-lag autocorrelation is separated by long lags, or "overreaction" and the confirmation that long-term reversals are induced by irrational trades upon the signal arrival. They suppose that both, short-term momentum and long-term reversal are heavier pronounced in less liquid securities and in those where information asymmetries are the highest, because retail investors' overconfidence is more severe here. This suggests greater inefficiencies from overconfidence in small firms, growth firms and firms with low analyst following (Fama and French, 1998). This implies that stocks with the most significant momentum effects also exhibit the most significant reversal effects.

The theory and underlying evidence also hold true for the observations during and after the WallStreetBets episode: The heaviest affected stock during the episode was GameStop Corp. Its price exploded from $18.84 in late December 2020 to $483 on January 28, 2021, before dropping to under $60 in the first days of February (according to public data from MarketWatch). Similar, but weaker momentum and reversal effects could be observed in a number of other, formerly rather illiquid stocks affected by the same trading patterns after being targeted by retail investors.

# 5. Reflection and outlook

This chapter provides a critical reflection of the developments as described in chapters 3 and 4 as well as an outlook on how these criticalities can be resolved, or at least, how they should be addressed. This chapter also entails a critical reflection of the thesis.

## 5.1 Critical reflection of the developments

The regulatory and informational developments outlined in subchapters 3.2 and 3.3 clearly benefit retail investors. Some of the developments also benefit financial markets as a whole, as they contribute to the overall goal of sustaining markets' safety, efficiency, and integrity. However, others also have adverse consequences for financial markets.

For example, stricter disclosure regimes for firms pose an unproportionally high organizational and regulatory burden on the institutions in scope. Further, disaggregated masses of firm level data only swamp retail investors with information which they cannot handle given limitations in time, resources, and cognition. Therefore, such disclosure regimes often create an elusive illusion of transparency. Likewise, having in place tight

disclosure and transparency regimes for professional investors but not retail investors, although they also account for an ever-increasing market and volume share, contributes to a behavioral change in attitude towards short term, high risk trading phenomena.

Technical advancements are beneficiary in general but when being looked at with a more differentiated view, display some ambivalence. For example, the SEC (2021) views the 'gamification' of trading (i.e. the use of game-like features in trading apps, such as points, rewards, leaderboards, and competitions) as a negative facet to mentioned. Gamified trading also includes behavioral prompts that e.g. encourage users to trade more or to enter into high risk strategies. But more active trading often results in lower returns for the average trader and following a hyped stock without information evaluation on a trading app could lead to substantial financial losses.

Another example is the common practice of payment for order flow, especially if payment from wholesalers is made to brokers. These wholesalers can decide upon execution of these orders, which leads to questionable and opaque execution quality of retail orders. Since more trades generate more payments for order flow, broker-dealers tend to encourage customers to trade more frequently than it would be in their best interest, and to accept inferior execution quality for them in return for higher payment for order flow.

A final example is social media. Whereas it provides many positive use cases, the use of social media w.r.t. financial advice seeking or providing is rather negatively connoted. Social media tools of today have far greater influence and anonymity than previous technologies, which attracts wrongdoers, who try to use such platforms to spread misinformation or manipulate markets. Also, as revealed by the WallStreetBets episode, social media provides room for anonymous collusion, which can lead to coordinated trading activities and disruptions of orderly price formation, or market manipulation in a broader sense. This damages market integrity and imposes losses on innocent bystanders.

## 5.2 Outlook

Given these developments which, besides all advancements, also feature some rather cumbersome aspects, regulators see themselves confronted with the question on how to adapt to and adequately reflect such developments in their oversight practice.

Concerning the issues related to payment for order flow, investors need better information about execution quality so they can see how their brokers are performing. Particularly, a helpful measure could be to oblige brokers to provide their retail clients with

standardized, easy-to-understand execution quality reports. Additionally, regulators could make it mandatory for online trading interfaces to warn retail investors if they place too many orders, or orders related to stocks that have previously moved with greater volatility. This can serve as a way of protecting retail investors against their own irrational and psychologically driven decisions.

Further, rules should adequately reflect that speculation always inherits financial losses for those participating. Related to that, Heimer and Simsek (2019) propose to consider leverage limits for retail investors in future rule-setting, to dis-incentivize socially inefficient speculation of retail investors as well as potential subsequent losses.

More generally, market manipulation rules should also be updated to properly reflect threats arising from public information channels such as chats or forums. In this context, a streamlined guidance on prohibitive misinformation strategies is required also considering the responsibility of retail investors active is such strategies.

A supplementary approach should be to directly diminish the benefit of providing misleading information by further fostering investor education. Equipping investors with a better understanding of financial statements and of the behavioral biases they are prone to provides the strongest motivation to produce sound information.

## 5.3 Critical reflection of the thesis

The thesis analyzes the changing role and trading behavior of retail investors. Therefore, three major aspects, namely behavioral aspects, regulatory aspects, and informational aspects have been chosen to investigate the developments between the GFC of 2007-2009 and the WallStreetBets episode in early 2021. Even though these aspects represent major drivers of change in the role and trading behavior of retail investors, there might be additional aspects which have played a role, such as e.g. the psychological shift in the risk culture of retail investors.

Regarding the academic literature on retail investor behavior used in this thesis, there are certain limitations and an ongoing discussion on the data quality used for identification of retail investors' trading behavior. Especially earlier studies relied on numerous data proxies to identify retail trading in market data, such as trade sizes. Even with the transparency levels of today's markets, it remains challenging to identify the concrete originator of a trade, especially when the respective trading participant is not disclosed. Same is true for identification of subgroups of retail investors (e.g. age cohorts) that may

fundamentally differ in the trading behavior and characteristics but only a handful of studies concentrate on disjoint analyses to differentiate retail investor specimen.
Further, the thesis focusses on the US jurisdiction only. Therefore, factors that matter for changes in retail investor' role and behavior in other countries are not considered.
Importantly, no concluding judgement from regulators or prosecutors is available yet on the WallStreetBets events. Therefore, long-term consequences such as regulatory responses are not foreseeable to date and consequently, not included in this thesis.

## 6. Conclusion

I conclude by summarizing the findings and answering the research question: "How did the role and investment behavior of retail investors change in the light of WallStreetBets?"
Today, retail investors are better informed, educated, technologically equipped, and more protected by regulation than ever before. Nevertheless, an individual retail investor may lack certain aspects of these developments and therefore individually still compare to the retail "lamb" acting between numerous institutional "lions", as pictured in the wake of the GFC. However, the changes in regulation and technology paired with the retail investors' tendency to mitigate individual behavioral weaknesses though collusion, coordination and collaboration, empowered retail investors to not only affect but drive financial markets when acting as a herd.
Key cornerstone of this change in their role and trading behavior on financial markets certainly comes from the persistent judgmental and decisional biases retail investors still face on an individual level which imply perceived disadvantages for them and have led to coordination and collaboration tendencies since technology provided respective possibilities to do so. These tendencies can also be observed in their trading activity on an aggregate level, such as sentiment signaling and herding behavior.
During the last decade, financial market regulation has focused on retail investor protection, which led to an additional empowerment of retail investors. Also, educational efforts have been increased, to improve retail investors' understanding of financial markets, products, and associated risks – including the behavioral biases they themselves tend to underlie. This deeper understanding of their nature has eventually provided them with valuable insights and potentially, enables them to overcome resulting disadvantages.

In parallel, technologies also have done their part in supporting retaliatory trading by providing retail investors with increasing possibilities, not only to collude, but also to get informed and to act more independent and flexible on financial markets. An important factor to mention here are neobrokers, which have reformed the way of retail investor trading with apps and fostered retail investor participation on markets by drastically reducing trading costs or even implementing a zero-commission model.

The WallStreetBets episode has vividly revealed that given certain market conditions, such as illiquidity in assets and amid collusion, as observed in predatory or swarm trading, retail investors are indeed able to turn the tide in their favor.

Concludingly, retail investors as the lambs of yesterday have certainly been bolstered by regulatory, informational, and technological advancements but are in general not the lions of today. Considering their individual and aggregate trading behavior, they have certainly (re-)gained confidence and have become more "lionish" during the last decade than they were after the GFC. However, it is important to stress that these developments should not be generalized: Still, retail investors are a heterogenous group of natural persons, of which some are more likely to exhibit animal spirits (i.e. heavier pronounced biases of overconfidence, attention, and emotions) when it comes to trading, than others.

Certainly, the WallStreetBets episode has revealed the role retail investors can take on in US equity markets nowadays in general, due to the aforementioned developments, but also, that this role has been amplified since the outbreak of the COVID-19 pandemic in particular.

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## V. Statutory Declaration

I herewith declare that I have composed the present thesis myself and without use of any other than the cited sources and aids. Sentences or parts of sentences quoted literally are marked as such; other references with regard to the statement and scope are indicated by full details of the publications concerned. The thesis in the same or similar form has not been submitted to any examination body and has not been published. This thesis was not yet, even in part, used in another examination or as a course performance.

Frankfurt am Main, 01 August 2021

Signature: .....