EXHIBIT 10

Staff Report on Equity and Options Market Structure Conditions in Early 2021



October 14, 2021

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1. Introduction

GameStop Corp ("GameStop" or "GME") and multiple other stocks experienced a dramatic increase in their share price in January 2021 as bullish sentiments of individual investors filled social media. As the companies' share prices skyrocketed to new highs, increased attention followed, and their shares became known as "meme stocks." Then, as the end of January approached, several retail broker-dealers temporarily prohibited certain activity in some of these stocks and options.

This report of the staff of the Securities and Exchange Commission ("SEC" or "Commission") primarily examines the January 2021 trading activity in GME, the most famous of meme stocks against the backdrop of contemporaneous trading activity in other meme stocks. Because the media attention surrounding the meme stock episode raised several questions about market structure, this report will begin with an overview of U.S. equity and options market structure and explain how individual investors' orders are typically handled.[1]

As more individual investors participate in the markets, as many did during the volatile trading in early 2021, it is important to understand how their orders are executed and the incentives of their broker-dealers when executing those orders. In particular, the ability of a small number of off-exchange market makers to trade profitably with retail order flow has led these market makers to negotiate agreements with retail broker-dealers to secure rights to this order flow. In turn, this payment for order flow creates incentives with regard to the end customer whose order flow is being sold. Some individual investors might trade more frequently as commissions have fallen or been eliminated, which raises questions about the effect of novel features (e.g., digital engagement practices) of their broker-dealers. The execution of retail orders by off-exchange market makers raises further questions about whether individual investors may still be subject to other less conspicuous costs and conflicts of interest. While these features are not necessarily the cause of the meme stock volatility, investors should be mindful of how their orders are handled, including the difference between "free" and "no commissions."

Dynamics related to short selling are also an integral part of the GameStop story. Stocks seen by parts of the market as overvalued tend to exhibit significant short interest, and prior to January 2021, GameStop was no different in this respect. However, some in the media directly

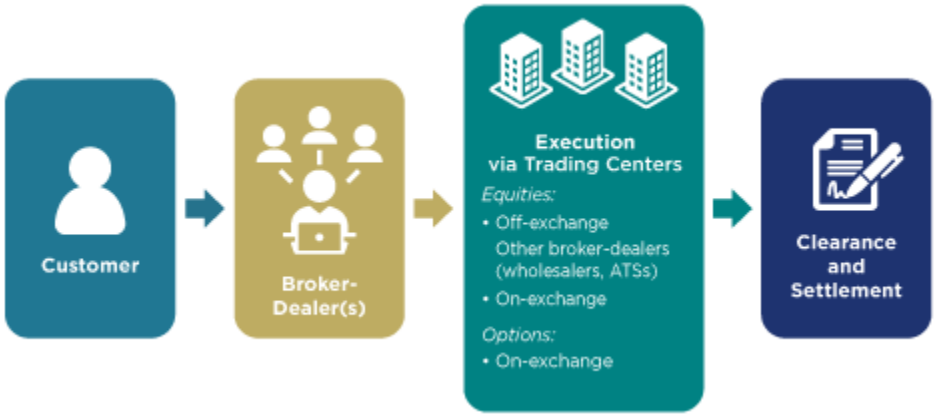
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[1] This report uses the term "individual investor" to mean a natural person who is "self-directed" (i.e., not acting on a recommendation by a broker-dealer), in contrast with professional investors or institutional investors. The term encompasses an individual who trades frequently or infrequently and in very small to large dollar amounts. The term "retail broker-dealer" refers to a broker-dealer that caters to individual investors. This definition of "individual investor" differs from the Consolidated Audit Trail ("CAT") definition of "individual customer account," which is also used in this report. See infra note 59.

linked trading activity to the presence of short interest, characterizing trading in GameStop as an act of rebellion intended to humble short-selling professional investors who had allegedly targeted the stock. Lastly, the episode highlighted the risks that exist while trades are settled and raised concerns about the mechanisms market participants use to manage those risks. Specifically, volatility combined with settlement risks led some firms to temporarily restrict trading. We discuss aspects of equity and options market structure below.

2. U.S. Market Structure and Securities Regulatory Framework

2.1 Equities and Options Market Structure



To understand what transpired in January 2021, it is necessary to understand the market structure within which the events occurred.[2] From the perspective of individual investors, the lifecycle of a stock trade starts with an investor placing an order through an account they establish with a broker-dealer.[3] The broker-dealer then routes the order for execution to a trading center, such as a national securities exchange, an alternative trading system ("ATS"), or an off-exchange market maker.[4] Once a trading center executes the order, the customer receives

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2 See, e.g., "Staff Report on Algorithmic Trading in U.S. Capital Markets," SEC Staff report (August 5, 2020), Sections II and X, available at: https://www.sec.gov/files/Algo_Trading_Report_2020.pdf.

3 Trading venues can have a wide variety of order types, but there are fundamentally two types: limit orders and market orders. Limit orders specify a price and will stay on an order book until an opposite order comes in that meets or beats that price. Alternatively, market orders are intended to be executed as soon as possible at the best available price.

4 Both ATSs and off-exchange market makers are also broker-dealers registered with the Commission under the Securities Exchange Act of 1934 ("Exchange Act"). Additionally, the first trading center a broker-dealer routes an order to may not execute the order and instead the order may get routed to one or more other trading centers.

a confirmation and the trade is reported to a securities information processor that collects, consolidates, and publishes the price and volume data to market data vendors and others. This processor will publicize the trade details (i.e., that the buyer and seller both report the same security, price, shares, and dollar amount). The trade details are also sent to the clearing broker, who affirms the trade by verifying the trade details. The clearing broker must "settle" an equity trade within two days of the trade date (called "T+2") by officially moving the stock from the seller's brokerage firm's account to the buyer's brokerage firm's account and moving the money from the buyer's brokerage firm to the seller's brokerage firm, a process facilitated by clearing agencies registered with the Commission under the Exchange Act.

Options market structure is broadly similar to equities market structure with several key differences. Specifically, "standardized listed options" are traded only on a national securities exchange, there are a vastly larger number of securities listed and traded, displayed liquidity is primarily derived from market maker quotes, and options settle on the next business day following the trade (T+1). With respect to the number of series of options for each underlying security, there are more than 10,000 listed stocks in the National Market System ("NMS stocks") and more than 1,000,000 options series.[5] Because of the large number of series, there are less likely to be investor limit orders resting on an exchange's order book in any one series at any given time, so prices are commonly set by registered market makers' quotes.

2.2 Overview of the Regulatory Framework

The Commission's mission is to protect investors, maintain fair, orderly, and efficient markets, and facilitate capital formation. In carrying out its mission, the Commission oversees self-regulatory organizations ("SROs") such as the national securities exchanges, the clearing agencies, and the national securities associations (namely, the Financial Industry Regulatory Authority, or "FINRA"), all of whom act as regulators of their broker-dealer members.[6] The

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5 Options are listed according to a "class," which represents the underlying security (e.g., ABC stock). Within each class, options are listed in series, which denote the options type ("call" or "put"), the strike price, and expiration date. For example, "ABC June $50 calls" refers to a call option on ABC with a strike price of $50 (giving the buyer the right, but not the obligation, to buy 100 shares of ABC stock at $50 on the expiration date in June regardless of the then-current price of ABC stock). Options are priced differently than stocks, as they are expressed as the premium on a per share basis, such that an option with a quote of $2 where one options contract represents 100 shares of underlying stock would cost $200 in premium.

6 Among other things, the Commission also helps investors gain access to materially complete and accurate information about companies and the securities they offer and sell; oversees investment companies and investment advisers; and investigates and brings civil charges in federal district court or in administrative proceedings based on violations of the federal securities laws.

SROs are subject to the Exchange Act. The Exchange Act includes various rules, requirements, and principles, such as those that prohibit exchanges from engaging in unfair discrimination and require them to promote the protection of investors and the public interest, as well as those that require SROs to file all proposed rule changes with the Commission.

Broker-dealers generally must register with the Commission under the Exchange Act and are subject to the federal securities laws as well as rules of, and oversight by, the SROs of which they are a member. Generally, broker-dealers that deal with the public in securities must become members of FINRA.[7] Broker-dealers are further subject to a number of regulatory requirements, both from the Commission and, as applicable, FINRA and exchanges of which they are a member, including customer account opening obligations, sales practices obligations, and net capital and other financial responsibility rules. A number of these rules and regulations impose obligations with respect to the handling of customer orders. Broker-dealers are subject to certain conduct requirements including the duty of "best execution," which generally requires a broker-dealer to execute customer orders at the most favorable terms reasonably available under the circumstances, generally, the best reasonably available price.[8] In addition, FINRA Rule 5320 (commonly referred to as the "Manning Rule") generally prohibits FINRA members from trading ahead of customer orders (e.g., receiving a customer order to buy and then buying for its own account first at a price that would satisfy the customer's order, without providing the customer with that price or better). Rule 605 and Rule 606 of Regulation NMS require public disclosures regarding order flow. Rule 605 requires a market center (i.e., exchanges, ATSs, and off-exchange market makers) to report data on the quality of executions on its market, while Rule 606 requires broker-dealers to make publicly available on a quarterly basis certain aggregated order routing disclosures for held orders.[9]

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7 See, e.g., Section 15(b)(8) of the Exchange Act, 15 U.S.C. 79o(b)(8) (concerning membership in a registered securities association).

8 See "FINRA Reminds Member Firms of Requirements Concerning Best Execution and Payment for Order Flow," FINRA Regulatory Notice 21-23 (June 23, 2021) (stating that "firms that provide payment for order flow for the opportunity to internalize customer orders cannot allow such payments to interfere with their best execution obligations[,]" and that "inducements such as payment for order flow and internalization may not be taken into account in analyzing market quality.").

9 See infra note 41 (describing Rule 606(a)). See also Securities Exchange Act Release No. 84528 (November 2, 2018), 83 FR 58338, 58340 n.19 (November 19, 2018) (noting that, typically, a "not held" order provides the broker-dealer with price and time discretion in handling the order, whereas a broker-dealer must attempt to execute a "held" order immediately).

2.3 Individual Investors and Retail Broker-Dealers

Individual investors access the markets through accounts at broker-dealers.[10] Broker-dealer customers can open "cash" accounts or "margin" accounts. With a cash account, the customer must pay the full amount for securities purchased. With a margin account, the broker-dealer loans the investor money with the securities in the investor's account serving as collateral. Individual investors in a margin account can use this money to purchase securities, sell securities short, or cover transactions in case their available cash falls below zero (i.e., overdraft).[11]

In order for a customer to trade options,[12] broker-dealers must conduct due diligence that options trading is appropriate for the individual customer. They often do this by requiring customers to obtain specific approval to open an options account, generally through completing an application that asks questions about the customer's investing experience, financial situation, and risk tolerance.[13] Depending on the customer's responses, the broker-dealer may limit the customer to lower levels of options trading representing lower degrees of risk.[14]

Retail broker-dealers have attracted customers by reducing commissions and offering more tools, features, functionality, and convenience to transact. Some use promotional or award programs to attract and retain customers, like offering a free share of stock upon account opening, offering tiered credits for certain levels of deposits or for transferring an account from

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10 See, e.g., "Investor Bulletin: How to Open a Brokerage Account," SEC Office of Investor Education and Advocacy (June 10, 2021), available at https://www.investor.gov/introduction-investing/general-resources/news-alerts/alerts-bulletins/investor-bulletins-43.

11 See, e.g., "Investor Bulletin: Understanding Margin Accounts, SEC Office of Investor Education and Advocacy" (June 10, 2021), available at https://www.investor.gov/introduction-investing/general-resources/news-alerts/alerts-bulletins/investor-bulletins-29.

12 See, e.g., "Investor Bulletin: Leveraged Investing Strategies – Know the Risks Before Using These Advanced Investment Tools," SEC Office of Investor Education and Advocacy (June 10, 2021), available at https://www.investor.gov/introduction-investing/general-resources/news-alerts/alerts-bulletins/investor-bulletins-2. See also Regulatory Notice 21-15, "FINRA Reminds Members About Options Account Approval, Supervision and Margin Requirements" (April 2021).

13 Pursuant to rules of FINRA, a registered national securities association, broker-dealers are required to make such approvals of any customer seeking to trade in options, prior to accepting an order from that customer to do so. See FINRA Rule 2360(b)(16) (Options). See also FINRA Regulatory Notice 21-15, "FINRA Reminds Members About Options Account Approval, Supervision and Margin Requirements" (April 2021).

14 "Investor Bulletin: Opening an Options Account," SEC Office of Investor Education and Advocacy (March 18, 2015), available at https://www.investor.gov/introduction-investing/general-resources/news-alerts/alerts-bulletins/investor-bulletins-77.

another broker-dealer, referral programs, or promotions involving celebrities and online influencers. Some retail broker-dealers have focused on designing simple trading apps that make it easier to trade from anywhere. Some have "social" features that allow customers to discuss stocks and trades and display their trades and portfolios to others. A number of features, which broadly include behavioral prompts, differential marketing, game-like features, and other design elements or features, appear designed to engage individual investors. These features, which have the potential to leverage large amounts of user data, raise questions about their effect on investor behavior that the Commission explored in a recent request for public comment.[15]

Some brokers have sought to attract new customers by offering the ability to purchase fractional shares.[16] Fractional shares give investors the ability to purchase less than 1 share of a stock.[17] Fractional share programs are specific to each broker-dealer, as stocks do not trade on exchanges in units less than 1 share, and trades may only be reported to a trade reporting facility in multiples of one share.[18]

Many brokers have eliminated trading commissions and lowered or eliminated account minimums. While not the first broker-dealer to offer zero commissions, Robinhood Financial, LLC ("Robinhood") attracted considerable attention when it launched its app, allowing users to

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15 See Securities Exchange Act Release No. 92766 (August 27, 2021), 86 FR 49067 (September 1, 2021) (File No. S7-10-21) (Request for Information and Comments on Broker-Dealer and Investment Adviser Digital Engagement Practices, Related Tools and Methods, and Regulatory Considerations and Potential Approaches; Information and Comments on Investment Adviser Use of Technology to Develop and Provide Investment Advice).

16 A number of prominent stocks have share prices that have appreciated to several hundred or even several thousands of dollars per share. When that happens, investors with modest account balances can afford to purchase fewer shares than if the stock was priced below, say, $50 per share. For example, an investor that has $500 to invest could purchase 10 shares at $50 per share, but cannot afford even a single share priced at $1,500.

17 Broker-dealer fractional share programs typically involve the broker-dealer maintaining a separate account in which it either aggregates customers together to form a full share (e.g., one customer buys .25 and another buys .75), or uses its own capital to purchase/sell a full share and give its customer the fraction (e.g., one customer buys .25 and the firm puts the remaining .75 into the special account to satisfy future customer fractional orders). Customers generally cannot transfer these factional shares to another broker-dealer. These programs vary by broker-dealer, and voting or proxy rights depend on the broker-dealer's policies. See "Investor Bulletin: Fractional Share Investing – Buying a Slice Instead of the Whole Share," SEC Office of Investor Education and Advocacy (November 9, 2020), available at: https://www.sec.gov/oiea/investor-alerts-and-bulletins/fractional-share-investing-buying-slice-instead-whole-share.

18 See "Trade Reporting Frequently Asked Questions #101.14," FINRA, available at https://www.finra.org/filing-reporting/market-transparency-reporting/trade-reporting-faq.

trade stocks for no commissions with no account minimums.[19] Other broker-dealers soon followed with apps offering no commissions and no minimums, including Webull Financial LLC,[20] and SoFi Securities LLC.[21] By the fall of 2019, other broker-dealers began to announce zero-commission trading for individual investor customers, including Interactive Brokers LLC,[22] TD Ameritrade, Inc.,[23] E*Trade Financial Corporation,[24] Ally Financial LLC,[25] Charles Schwab Corporation,[26] and Fidelity Investments Inc.[27]

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19 "Start Investing. Stop Paying." Robinhood (March 12, 2015), available at: https://blog.robinhood.com/news/2015/3/11/start-investing-stop-paying.

20 Press Release, "Webull Financial Launches Comprehensive Commission-free Stock Trading App," Webull Financial LLC (May 30, 2018), available at: https://www.prnewswire.com/news-releases/webull-financial-launches-comprehensive-commission-free-stock-trading-app-300656353.html.

21 Press Release, "SoFi Announces Availability of SoFi Money and Invest Products to Help You Get Your Money Right," Sofi Securities LLC (February 26, 2019), available at: https://www.sofi.com/press/sofi-announces-availability-sofi-money-invest-products-help-get-money-right/.

22 Press Release, "Interactive Brokers to Launch IBKR Lite New service to offer zero commissions and no fees," Interactive Brokers Group, Inc. (September 26, 2019), available at: https://investors.interactivebrokers.com/en/index.php?f=45393.

23 Press Release, "The Best Just Got Better: TD Ameritrade Introduces $0 Commissions for Online Stock, ETF and Option Trades," TD Ameritrade Holding Corporation (October 1, 2019), available at: https://www.tdainstitutional.com/content/dam/institutional/resources/press-releases/oct_1_pricing_press_release.pdf.

24 Press Release, "#1 Digital Broker E*Trade Announces $0 Base Rate Commissions For Online Stock, ETF, and Options Trades," E*Trade Financial Corp. (October 2, 2019), available at: https://cdn2.etrade.net/1/19100221100.0/aempros/content/dam/etrade/about-us/en_US/documents/newsroom/press-releases/2019/5545607436705191.pdf.

25 Press Release, "Ally Invest Joins the Zero Commission Movement," Ally Financial Inc. (October 4, 2019), available at: https://media.ally.com/2019-10-04-Ally-Invest-Joins-the-Zero-Commissions-Movement.

26 Press Release, "In Conjunction With Chuck Schwab's New Book "Invested," Schwab Removes the Final Pricing Barrier to Investing Online by Eliminating U.S. Stock, ETF and Options Commissions," Charles Schwab & Co., Inc. (October 1, 2019), available at: https://pressroom.aboutschwab.com/press-releases/press-release/2019/In-Conjunction-With-Chuck-Schwabs-New-Book-Invested-Schwab-Removes-the-Final-Pricing-Barrier-to-Investing-Online-by-Eliminating-U.S.-Stock-ETF-and-Options-Commissions/default.aspx.

27 Press Release, "Fidelity Becomes The Only Firm That Offers Zero Commission Online Trading, Automatic Default To Higher Yielding Cash Option For New Accounts And Leading Trade Execution," Fidelity Investments (October 10, 2019), available at:

Though retail broker-dealers have reduced commissions, some have maintained or increased other sources of revenue, such as: (1) payment for order flow; (2) advisory services or managed accounts from broker-dealers that are dually registered as investment advisers or from affiliated investment advisers; (3) interest earned on margin loans and cash deposits; (4) income generated from securities lending; and (5) fees from additional services. Recent Commission enforcement actions have highlighted some of the conflicts faced by broker-dealers.[28]

Some broker-dealers report that younger investors and smaller accounts have been notable sources of new account openings. For example, Charles Schwab indicated that individual investor customers age 40 and below, with account balances below $100,000, are driving a greater percentage of trading volume than in prior periods.[29] Robinhood reported that its average customer is 31 years old and has a median account balance of $240.[30] Apex Clearing

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https://clearingcustody.fidelity.com/app/literature/press-release/9896568/fidelity-becomes-the-only-firm-that-offers-zero-commission-online-trading-automatic-default-to-higher-yielding-cash-opt.html#:~:text=Insights-,Fidelity%20Becomes%20the%20Only%20Firm%20that%20Offers%20Zero%20Commission%20Online,to%20Investors%20of%20all%20Types.

28 See, e.g., In the Matter of Robinhood Financial, LLC, "Order Instituting Administrative and Cease-and-Desist Proceedings Pursuant to Section 8A of the Securities Act of 1933 and Section 15(b) of the Securities Exchange Act of 1934, Making Findings, and Imposing Remedial Sanctions and a Cease-and-Desist Order," Securities Exchange Act Release No. 90694 (December 17, 2020) ("Robinhood Order") (settled order), available at: https://www.sec.gov/litigation/admin/2020/33-10906.pdf (discussing the trade-off between payment for order flow and price improvement and how Robinhood took approximately a 20/80 split of the value between price improvement and payment for order flow, which was a substantially higher percentage to Robinhood than the typical 80/20 rate the principal trading firms paid to other retail broker-dealers); and In the Matter of Cantella & Co., Inc., "Order Instituting Administrative and Cease-and-Desist Proceedings, Pursuant to Section 15(b) of the Securities Exchange Act of 1934 and Sections 203(e) and 203(k) of the Investment Advisers Act of 1940, Making Findings, and Imposing Remedial Sanctions and a Cease-and-Desist Order," Securities Exchange Act Release No. 92809 (August 30, 2021) (settled order), available at: https://www.sec.gov/litigation/admin/2021/34-92809.pdf (discussing revenue sharing payments in connection with cash sweep products).

29 See, e.g., Past CFO Commentary, Charles Schwab & Co. (March 12, 2021), available at: https://www.aboutschwab.com/cfo-commentary/mar-2021.

30 See, e.g., "Young, confident, digitally connected - meet America's new day traders," Reuters (February 2, 2021), available at: https://www.reuters.com/article/us-retail-trading-investors-age/young-confident-digitally-connected-meet-americas-new-day-traders-idUSKBN2A21GW; and Testimony of Vladimir Tenev, Co-Founder and CEO of Robinhood Markets, Inc., at Sec. IV, Hearing Before the U.S. House Committee on Financial Services (February 18, 2021), available at:

Corporation, a broker-dealer that provides services to other broker-dealers, has indicated that the approximately 6 million accounts it opened in 2020 represent a 137% increase from the year before, with about 1 million of those accounts belonging to investors with an average age of 19.[31]

2.4 Order Execution and Segmentation of Individual Investor Flow

A myriad of market participants and trading venues facilitate the execution of equity and options orders. While customers set the terms of their orders, the retail broker-dealer generally controls where to route the order for execution, subject to a duty of "best execution," discussed above.[32]

For stocks, trades execute either "on exchange" (i.e., on one or more of 16 registered national securities exchanges that list and/or trade stocks, sometimes called "lit" exchanges) or "off exchange" (e.g., on one or more of 34 ATSs that trade NMS stocks or by off-exchange market makers).[33] Exchanges play a central role in price discovery, as the exchange quotes (composed of interest from registered market makers and displayed orders from non-market

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https://financialservices.house.gov/uploadedfiles/hhrg-117-ba00-wstate-tenevv-20210218.pdf.

31 See, e.g., "Young, confident, digitally connected - meet America's new day traders," Reuters (February 2, 2021), available at: https://www.reuters.com/article/us-retail-trading-investors-age/young-confident-digitally-connected-meet-americas-new-day-traders-idUSKBN2A21GW.

32 Customers can use "marketable" orders (i.e., an unpriced "market" order seeking an immediate execution at prevailing prices, or a "limit" order with a specified limit price that allows an immediate execution at prevailing prices) or "non-marketable" orders (i.e., an order whose limit price does not allow it to execute immediately but rather must wait until a contra-side order comes to trade with it).

33 National securities exchanges must register with the Commission under the Exchange Act, but off-exchange market makers currently are not subject to specific registration requirements (though they must be registered as broker-dealers). While staff does not know the precise number of broker-dealers that hold themselves out as off-exchange market makers, staff understands from regulatory reports that the segment is highly concentrated with a few particularly dominant firms. See, e.g., infra note 41 (discussing Rule 606 reports).

makers) are the reference price for trades that execute off exchange.[34] Less than 60% of overall equities volume is typically executed on exchanges.[35]

Retail brokers commonly send the orders of their individual investor customers to off-exchange market makers, one example of a practice called "segmentation." For stocks, off-exchange market makers may execute individual investor orders by taking the other side of the trade principally ("internalizing" the trade) or may route the order to other trading venues for execution. For options, off-exchange market makers act as "consolidators" by purchasing individual investor options order flow. They cannot execute that flow off exchange because The Options Clearing Corporation ("OCC") generally only accepts for clearing standardized listed options that traded on an exchange.[36] Instead, they choose the options exchange on which to execute the orders, perhaps based on where they (or an affiliate) are most likely to trade with the order as principal.[37]

Off-exchange market makers have more flexibility compared to on-exchange participants because they are not subject to the rules of the exchanges on which they quote. For example, exchanges are required under Rule 612 of Regulation NMS to price displayed orders for stocks in penny increments, whereas wholesalers can execute more freely in sub-pennies when transacting off exchange. At the same time, off-exchange market makers use the public quotes submitted by on-exchange participants when setting the prices at which they execute individual investor orders off exchange.

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34 Stock prices are reflected in the best priced "bid" (order to buy, e.g., at $10) and the best priced "offer" (order to sell, e.g., at $10.05) resting on exchange order books. The difference between the bid and offer is known as the "bid-ask spread." While each exchange has its own best bid and offer, all such prices across all exchanges collectively enter into the National Best Bid and Offer ("NBBO").

35 See, e.g., "U.S. Equities Market Volume Summary," Cboe Exchange, Inc., available at: https://www.cboe.com/us/equities/market_share/.

36 See, e.g., OCC Bylaws Article I.C(27) (defining "confirmed trade" as one that is "effected on or through the facilities of an Exchange" or "affirmed through the facilities of an OTC Trade Source"). See also "OTC Products," OCC, available at: https://www.theocc.com/Clearance-and-Settlement/Clearing/OTC-Products (noting that OCC offers clearing services for OTC products on S&P 500 index options).

37 Consolidators may be affiliated with, or have an arrangement with, an options market maker. Options exchanges offer consolidators the ability to "direct" orders to an affiliated market maker, and the market maker gets a guaranteed allocation (e.g., 40%) if they are quoting at the best price. Some options exchanges also offer "price improvement auctions," in which a customer order can be exposed for price improvement over the published quotes.

Off-exchange market makers use segmentation to mitigate one of the key risks traders face—prices moving against their positions after executing a trade. Some in the marketplace may possess superior information about underlying asset values and will only buy when posted prices are low relative to their information, and sell when they are high. Other participants may, by virtue of greater quantities of data, have statistically greater predictive ability regarding the direction of prices. Because market makers are more likely to lose money when interacting with such order flow, they have an incentive to distinguish order flow that does not correlate with future price movements from order flow that does. The bid-ask spread, the difference between what a buyer is willing to pay and a seller willing to accept, normally compensates market makers for the risk that prices may move against them.[38] To the extent that market makers can segment order flow that is less correlated with future prices, they can offer a lower spread when trading with this order flow. Besides differing in the motive for trading, such orders are more likely to be small, uncorrelated with one another, and thus "one and done" (i.e., not the first in a series of orders intended to transact a large amount of stock), which also allows for a tighter spread.[39]

Off-exchange market makers typically offer payment to the retail broker-dealer for the right to trade with its customer order flow (i.e., payment for order flow).[40] These payments can create a conflict of interest for the retail broker-dealer. In contrast to fees and rebates charged or paid by exchanges (discussed below), off-exchange payments are individually negotiated prior to

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38 See, e.g., Glosten, Lawrence R. and Paul R. Milgrom (1985), "Bid, Ask, and Transaction Prices in a Specialist Market with Heterogeneously Informed Traders," *Journal of Financial Economics*, 14(1), 71-100.

39 When evaluating price improvement, it is important to note that the NBBO displayed across exchanges does not include many of the best prices available on exchanges, such as odd lots and non-displayed orders. A significant amount of activity transacts at prices within the NBBO (even on exchanges). See Securities Exchange Act Release No. 90610 (December 9, 2020), 86 FR 18596 (April 9, 2021) (File No. S7-03-20) (adopting rule changes concerning a new round lot definition and including odd-lot quotations in core data, which, when implemented, will allow individual investors to see, and more readily access, better-priced quotations). While stocks can execute in a variety of ways, Rule 611 of Regulation NMS generally prevents stocks from executing at prices worse than the NBBO. Additionally, in order to avoid the risks of adverse selection, the smart order routers of executing brokers often break up a large order (often referred to as the parent order) into a number of smaller orders (often referred to as the child orders). A small order may thus be followed by a small order in the same direction, a situation which a market maker would like to avoid. Handling large volumes of orders also provides off-exchange market makers with enormous quantities of data that can be used to design and improve trading and risk management strategies.

40 Payment for order flow is prevalent in the options market, potentially more so than in the equities market, but order flow that is purchased by consolidators is executed on exchange. See supra notes 36-37 and accompanying text.

trading between the retail broker-dealer and the off-exchange market maker,[41] and the rates and amounts can vary substantially depending on the broker-dealer and its customer order flow. Off-exchange market makers may give the retail broker the choice of how to allocate those funds—either by applying some or all of that payment to improve the prices of its customers' orders or by allowing the retail broker-dealer to keep part of the payment for itself.[42]

Most exchanges offer a form of payment for order flow wherein they compensate firms that provide liquidity with rebates and charge firms that take liquidity.[43] For stocks, some exchanges have retail liquidity programs that allow special order types to interact only with designated "retail" orders, which may be supplemented by pricing incentives. For options, these come in the form of "marketing fees"[44] as well as transaction rebates. In contrast to wholesalers (as well as ATSs), pricing incentives offered by equity and options exchanges are considered to be rules of the exchange, so these pricing incentives are subject to the filing requirements of the Exchange Act and must be publicly posted.

While stocks can execute in a variety of ways, Rule 611 of Regulation NMS generally prevents stocks from executing at prices worse than the NBBO. The Commission recently adopted rules that will materially improve the NBBO once those changes are fully implemented, including reducing the size of rounds lots for higher-priced shares and including some odd-lot

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41 Rule 606(a) under the Exchange Act requires broker-dealers to make publicly available on a quarterly basis certain aggregated order routing disclosures for held orders that provide, among other things, detailed disclosure of payments received from or paid to certain trading centers and also requires a discussion of the material aspects of broker-dealers' relationships with those trading centers, including a description of any arrangements for payment for order flow and any profit-sharing relationships and a description of any terms of such arrangements, written or oral, that may influence broker-dealers' order routing decisions. See 17 CFR 242.606.

42 See, e.g., Robinhood Order, supra note 28 (discussing the trade-off between payment for order flow and price improvement and how Robinhood took approximately a 20/80 split of the value between price improvement and payment for order flow, which was a substantially higher percentage to Robinhood than the typical 80/20 rate the principal trading firms paid to other retail broker-dealers).

43 These exchanges are known as "maker/taker" venues, wherein limit orders are paid a rebate by the exchange while market orders pay the access fee to the exchange. Alternatively, "taker/maker" venues give a rebate to market orders and charge limit orders the access fee.

44 Generally speaking, marketing fees are collected by options exchanges from market makers when they trade with "customer" orders, pooled, and paid out by specified market makers to order flow providers to encourage them to send order flow to the exchange.

quotations in core data.[45] However, the availability, particularly for individual investors, of prices better than the national "best" bid (or offer, as applicable) highlights the limitations of relying on the NBBO as the reference point for measuring retail execution quality. For example, it does not include off-exchange liquidity or many of the best exchange prices, such as odd lots and non-displayed orders.[46] A significant amount of activity appears to transact within the NBBO (even on lit exchanges),[47] so price improvement statistics based on the NBBO may overstate the actual price improvement.

2.5 Clearance and Settlement

When retail broker-dealers restricted buying in certain stocks in January 2021, the clearing process, normally in the background, entered the public debate. Clearing agencies act as the central counterparty for almost all equities and options trades in the U.S. markets by functionally serving as the buyer to every seller and the seller to every buyer to lessen the risks associated with one counterparty to the trade failing to perform (i.e., deliver the securities or the money to pay for them).[48] This guarantee is particularly valuable when a stock is experiencing pronounced volatility in its price.[49] Registered clearing agencies are subject to a range of regulatory requirements, including those related to clearing member margin and capital.

Clearing agencies are essential to managing the risk of failure of trades to clear (i.e., the process of transmitting, reconciling, and in some cases, confirming transactions prior to settlement) and settle (i.e., the exchange of money for the securities involved in the trade). The

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45 See supra note 39 (citing to Release No. 34-90610 concerning recently adopted changes for a new round lot definition and including odd-lot quotations in core data).

46 See id. (citing to Release No. 34-90610 concerning recently adopted changes for a new round lot definition and including odd-lot quotations in core data).

47 See, e.g., "U.S. Exchanges Hidden Rate (%)," SEC, available at: https://www.sec.gov/marketstructure/datavis/ma_exchange_hiddenrate.html#.YPc78ehKgq8.

48 There are two main types of registered clearing agencies: depositories and clearing corporations. Depositories—namely, The Depository Trust Company—hold securities certificates for their participants, transfer positions between participants, and maintain ownership records. Clearing corporations—such as the National Securities Clearing Corporation ("NSCC")—often act as intermediaries in making securities settlements, comparing member transactions, clearing those trades, and preparing instructions for automated settlement of those trades.

49 For example, if a buyer executes a trade at $100 per share on Monday, but the price falls to $20 on T+2, the buyer might regret the trade and seek to not follow-through with the purchase. The central counterparty guarantees the seller that the transaction will go through even if the buyer fails to perform.

clearing agency for the U.S. equities markets, NSCC, a subsidiary of the Depository Trust and Clearing Corporation ("DTCC"), maintains a "Clearing Fund" into which its member broker-dealers contribute margin to protect NSCC from potential losses arising from a defaulted member's portfolio until it is able to close out that member's positions. The Clearing Fund consists of required deposits posted by members in the form of cash and eligible securities. Typically, the largest portion of a member's Clearing Fund requirement is the volatility component, which estimates the future risk of the cleared portfolio over a given time horizon at a 99th percentile level of confidence. To determine the volatility component for most securities, NSCC uses a parametric Value at Risk model based on historical price movements. While margin requirements typically change in response to broad-based market movement, the NSCC's margin framework also allows for both intraday mark-to-market calls and additional special charges from clearing members if NSCC observes unusual volatility in specific securities that it believes would present heightened risk to the clearing agency and its members. Pursuant to its existing rules, NSCC can also impose excess capital premium ("ECP") charges for members who present a degree of margin exposure for their cleared positions that exceed those members' excess net capital. ECP charges are "designed to address significant, temporary increases in a Member's Required Deposit based upon any one day of activity."[50] To help members understand their potential required Clearing Fund deposit, NSCC provides certain calculators and information that allow members to monitor their risk and estimate their potential Clearing Fund requirements for actual or hypothetical portfolios.

Similarly, OCC is the clearing agency for listed options for its 16 participant options exchanges. OCC clears and settles listed options trades executed by its clearing members on a proprietary basis as well as for clients. In addition, OCC serves other financial markets, including the commodity futures, commodity options, security futures, securities lending, and the over-the-counter options markets.

3. GameStop: What Happened

3.1 The Run-Up to January 2021 and Increasing Individual Investor Participation

The underlying causes of the meme stock phenomenon that are unrelated to market structure are a subject of speculation that is beyond the scope of this report. Regardless of the causes, many individual investors traded in the meme stocks, which may reflect increases in

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50 See Securities Exchange Act Release No. 79598 (December 19, 2016), 81 FR 94462 (December 23, 2016) (SR-NSCC-2016-005) (Order Granting Approval of Proposed Rule Change to Accelerate its Trade Guaranty, Add New Clearing Fund Components, Enhance its Intraday Risk Management, Provide for Loss Allocation of "Off-the-Market Transactions," and Make Other Changes).

investor participation in 2020 in both the equities[51] and options markets.[52] By early 2021, increasing numbers of individual investors were downloading apps for broker-dealers.[53]

Against that backdrop, in January 2021, more than 100 stocks experienced large price moves or increased trading volume that significantly exceeded broader market movements. For some of these stocks, the amount of "short interest," measured as the number of shares sold short

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51 For example, off-exchange equities activity, a partial proxy for retail activity because retail orders are typically routed to off-exchange market makers and executed off exchange, continued to grow throughout 2020 with the 60-day moving average rising from 38.4% on March 23 to 46.5% at the end of the 2020 and the single day percentage exceeding 50% for the first time on December 23, 2020 at 50.4%. Source: Cboe Exchange, Inc. at https://www.cboe.com/us/equities/market_share/ and SEC Division of Trading and Markets ("TM") staff calculations. In December 2020, over the counter non-exchange listed equity volume (including "penny" stocks) surged, with a daily average of nearly 50 billion shares, compared to roughly 14.7 billion shares per day in November 2020, which had been the most active month over the prior two years. Source: FINRA at https://otce.finra.org/otce/marketStatistics.

52 By the end of the first quarter of 2020, standardized listed options trading had grown to over 30 million contracts a day on average, more than 50% higher than the 19.6 million contracts per day traded in December 2019. Source: The Options Clearing Corporation for options data at https://www.theocc.com/Market-Data/Market-Data-Reports/Volume-and-Open-Interest/Historical-Volume-Statistics and TM staff calculations. Further, the percentage of options volume stemming from small trades of just one contract on 50 of the most-traded stocks had risen to 14% from 10% at the end of 2019 and retail broker-dealers reported large or record levels of options trades. See, e.g., "Free Trades, Jackpot Dreams Lure Small Investors to Options," Wall Street Journal (June 24, 2020), available at: https://www.wsj.com/articles/free-trades-jackpot-dreams-lure-small-investors-to-options-11592991000?shareToken=st8d4344fa898440e284dd8beb6951960d. Further, the average size of electronic auctions fell by mid-2020 to six contracts per auction from around nine contracts, while the number of auctions per day grew by about 134%. See, e.g., "Q2 2020 Options Review: Record Volumes Continue," NYSE (July 14, 2020), available at https://www.nyse.com/data-insights/q2-2020-options-review. Through the remainder of 2020, options volume remained high and ended the year at with an average of 34.3 million contracts trading per day in December 2020, the most active month of 2020, compared to a daily average of 24.5 million contracts in January 2020. Source: The Options Clearing Corporation at https://www.theocc.com/Market-Data/Market-Data-Reports/Volume-and-Open-Interest/Historical-Volume-Statistics.

53 In January, reports mentioned a notable increase in broker-dealer app downloads, including Robinhood (more than 3 million) and Webull (more than 800,000). See, e.g., "Robinhood Appears to be Benefiting from the Trading Controversy, Seeing Record App Downloads," CNBC (February 1, 2021), available at: https://www.cnbc.com/2021/02/01/robinhood-appears-to-be-benefitting-from-the-trading-controversy-seeing-record-app-downloads.html.

as a portion of the total shares outstanding, exceeded the market average, while others had frequent mentions on social media, including Reddit. Notably, many of the stocks were consumer-focused companies that were familiar names to the public.

GME experienced a confluence of all of these factors: (1) large price moves, (2) large volume changes, (3) large short interest, (4) frequent Reddit mentions, and (5) significant coverage in the mainstream media. The price and volume movements in GME coincided with substantial interest expressed in certain online forums devoted to investing, including YouTube channels and the subreddit WallStreetBets. Some social media posts heavily touted the prospects for GME. Some of this discussion argued that GME was undervalued based on fundamental analysis and therefore constituted an attractive investment, while other discussion focused on its ability to transition to an e-commerce company. Alternatively, others contended that unusually high levels of short interest in GME presented the potential for a coordinated "short squeeze."

3.2 GME Equities Trading

GME's stock exhibited substantial volatility throughout the prior year. At the start of 2020, GME was priced at just over $6 per share. By April 2020, it had fallen by 50% to under $3 per share. News about GameStop led to large swings in price and increased volume. For example, on August 31, 2020, Chewy, Inc. ("Chewy") co-founder Ryan Cohen disclosed an investment in GameStop.[54] That day, GME's share price closed up 23.93% over the prior day ($6.68), with 38 million shares traded, totaling 34 million more than the prior day.[55] By the end of 2020, GME traded for a little under $20 per share. GME's closing price went from approximately the bottom 10th percentile to approximately the median over the course of the year.[56]

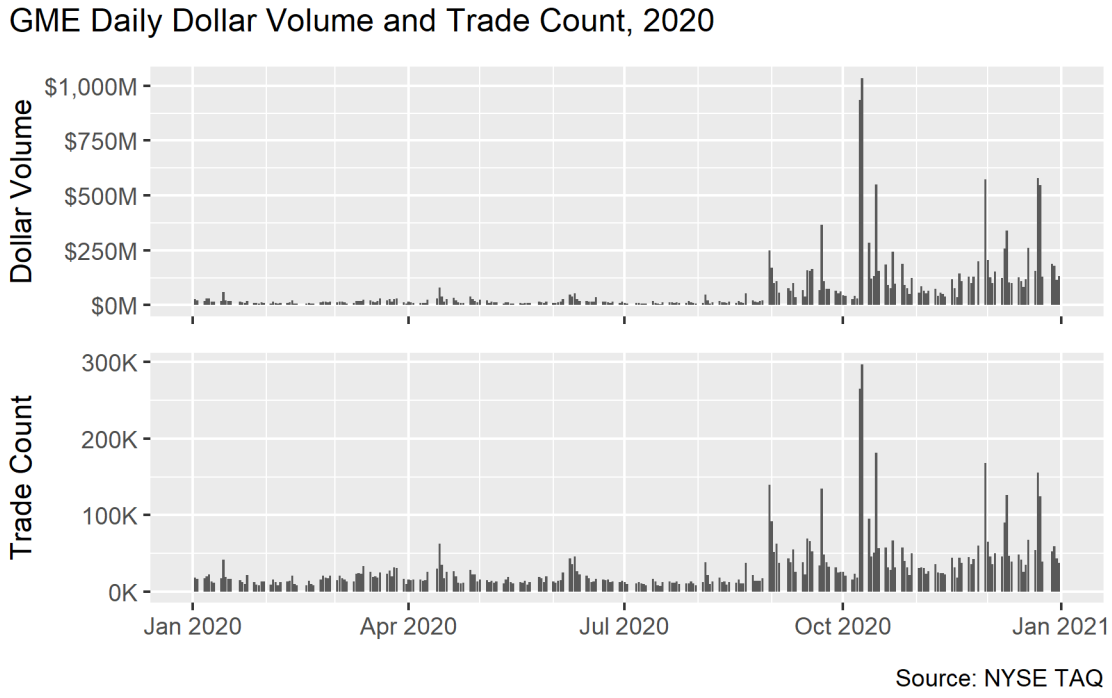
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54 See Schedule 13-D filed on August 18, 2020 by RC Ventures LLC, available at https://www.sec.gov/Archives/edgar/data/0001822844/000101359420000670/rc13d-082820.htm.

55 For all of 2020, GME's average daily share volume was approximately 6.7 million shares per day. Source: NYSE TAQ.

56 The standard deviation of daily closing price returns for GME in 2020 was 7.46%.

Figure 1



GameStop had already started to receive attention on Reddit in 2019, including in discussions about short squeezes. That attention grew throughout 2020. For instance, GME's short interest ratio of 84% was reportedly noted on Reddit in April 2020.[57]

Price increases, trading interest, and social media interest all accelerated in 2021 (Figures 2 and 3). Media attention on GME increased with the January 11 announcement that Mr. Cohen, of Chewy, would join the GameStop board of directors.[58] That day, GME reached an intra-day high of $20.65, approximately 17% above its prior day closing price. GME's price and volume began to increase noticeably on January 13, when the closing price rose to $31.40 from $19.95 the prior day, and the share volume rose to approximately 144 million shares, compared with approximately 7 million shares the day before. On January 22, 2021, the price of GME rose from $43 to $72 (a 71% increase) in approximately three hours. By January 27, GME closed at a high of $347.51 per share, representing a more than 1,600% increase from its closing price on January 11. The following day, share prices jumped further to an intraday high of $483.00. As the price increased, so too did the trading volume. From January 13-29, an average of approximately 100 million GME shares traded per day, an increase of over 1,400% from the

57 See, e.g., "How WallStreetBets Pushed GameStop Shares to the Moon," Bloomberg (January 25, 2021), available at https://www.bloomberg.com/news/articles/2021-01-25/how-wallstreetbets-pushed-gamestop-shares-to-the-moon.

58 See, e.g., "GameStop Soars With Activist Ryan Cohen Gaining Board Seats," Bloomberg (January 11, 2021), available at https://www.bloomberg.com/news/articles/2021-01-11/gamestop-soars-with-activist-ryan-cohen-gaining-board-seats.

2020 average. On January 22, 2021, the day of GME's highest share volume in the month, 197.2 million GME shares traded.

Overall, GME's intraday share price increased approximately 2,700% from its intraday low on January 8 to its intraday high on January 28, followed by a decrease of over 86% from that day to the closing price at the end of the first week of February. The daily closing price changes at the end of January were also highly volatile in dollar terms, ranging from a rise of $199.53 (between January 26 and 27) to a fall of $153.91 (between January 27 and January 28).

Figure 2

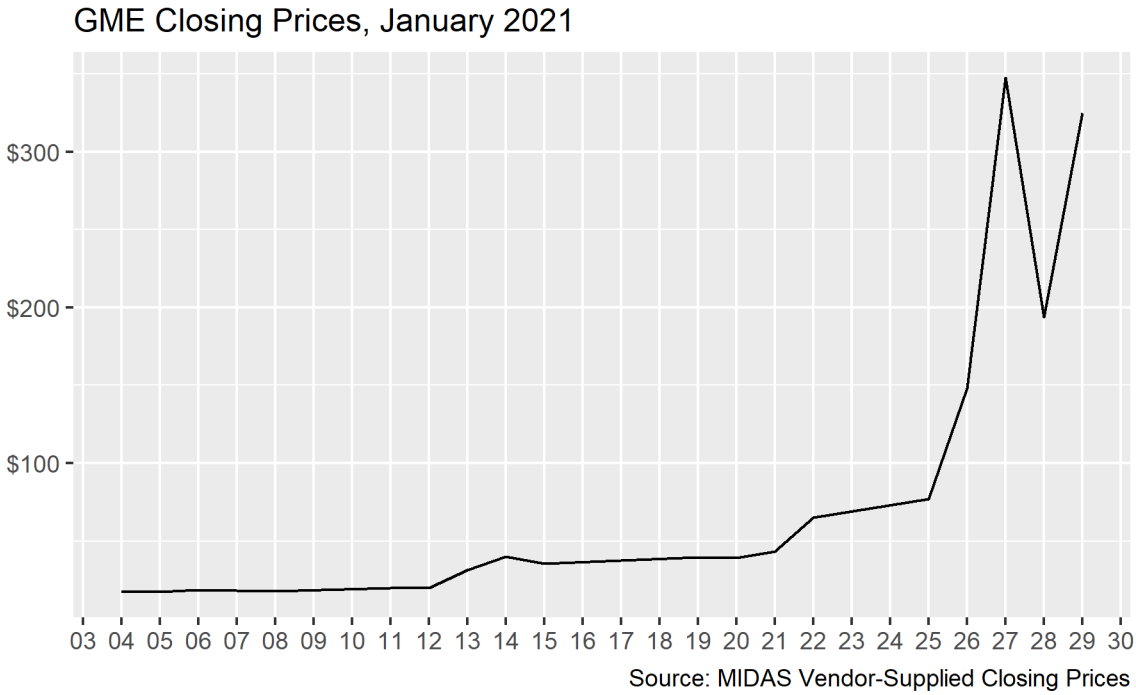
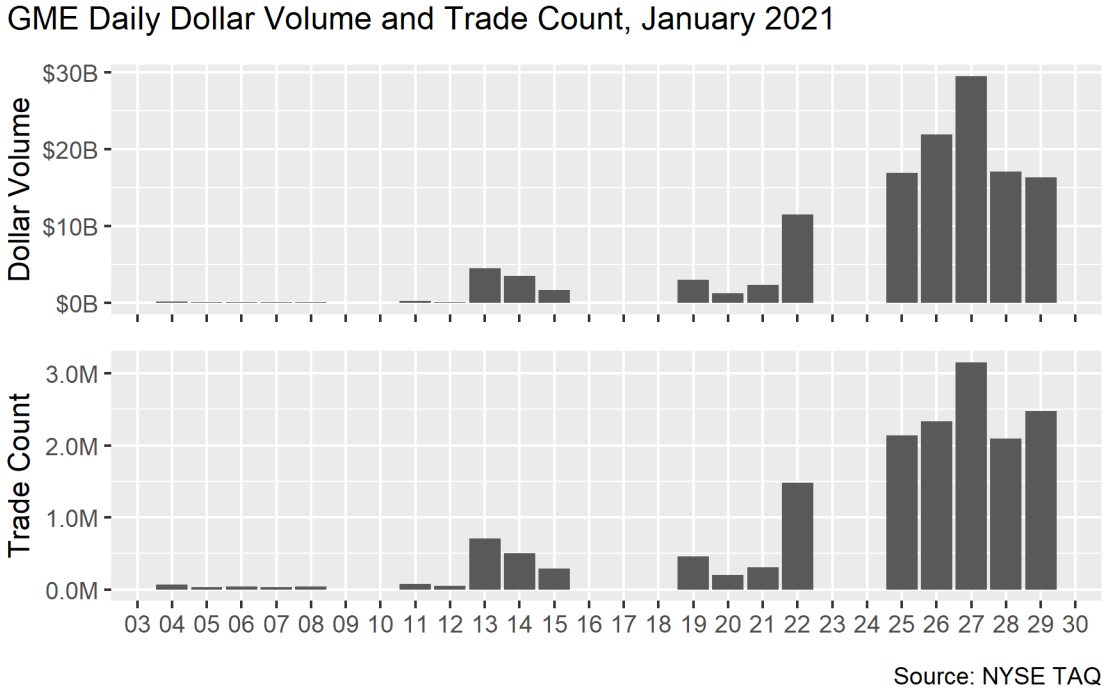


Figure 3



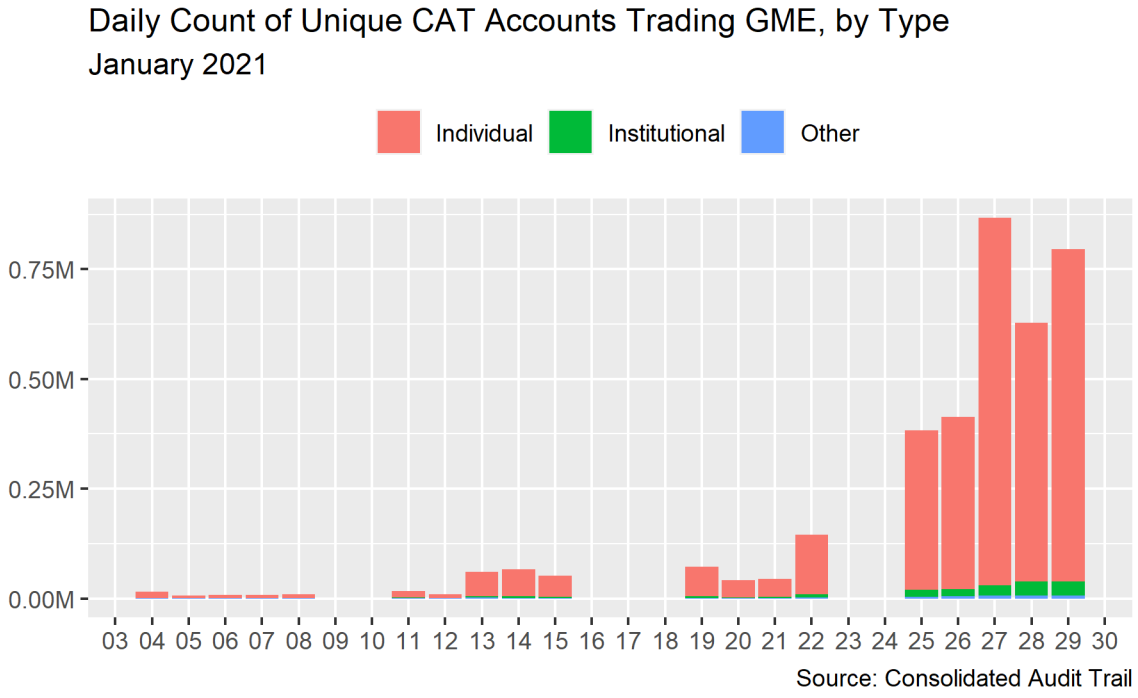
The increases coincided with a sharp increase in the number of individual accounts actively trading GME.[59] As shown in Figure 4, below, by January 27, the number of unique accounts trading GME on a given day increased from less than 10,000 at the beginning of the month to nearly 900,000.[60]

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59 For CAT purposes, "account" type definitions are available for the field name "accountHolderType" in Appendix G to the CAT Reporting Technical Specifications for Industry Members (https://catnmsplan.com/). Account types represent the beneficial owner of the account for which an order was received or originated. Possible types are: Institutional Customer, Employee, Foreign, Individual Customer, Market Making, Firm Agency Average Price, Other Proprietary, and Error. An institutional customer account is defined by FINRA Rule 4512(c) as a bank, investment adviser, or any other person with total assets of at least $50 million. An individual customer account means an account that does not meet the definition of an "institution" and is also not a proprietary account.

60 On January 13, 2021, the number of unique accounts trading GME, as reflected in the CAT, rose over 6 fold from the prior day, from 9,220 to 60,515.

Figure 4



Some institutional accounts had significant short interest in GME prior to January 2021.[61] GME short interest (as a percent of float) in January 2021 reached 122.97%, far exceeding other meme stocks like Dillard's, Inc. (symbol: DDS) (77.3%), Bed Bath & Beyond, Inc. (symbol: BBBY) (66.02%), National Beverage Corp. (symbol: FIZZ) (62.59%), Koss Corp. (symbol: KOSS) (0.92%), Naked Brand Group, Ltd. (symbol: NAKD) (7.3%), and AMC Entertainment Holdings Inc. (symbol: AMC) (11.4%).

In addition to individual investor activity, there was significant participation by institutional investors, including several hedge funds that purchased GME. Some of those purchases may have been used, at least in part, to cover short positions. The potential of "buy-to-cover" volume to increase share prices, thus leading to further buys to cover is often referred to as a "short squeeze." The role a short squeeze may have played is discussed further below.

After peaking in late January, the volume of trading in GME shares and GME's price declined substantially. GME's decline coincided with several brokerages' decision to restrict trading in GME on January 28, discussed below. By February 3, GME's price was below $100 per share, and fell as low as $40.59 by February 19, still significantly above its January 4 closing price. GME's price rose back above $100 at the end of February and has remained above that level since.

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[61] Through most of 2020, GME's short interested hovered around 100% as a percentage of public float.

By the end of January 2021, some funds had closed out their short positions in meme stocks, realizing significant losses.[62] In contrast, some funds that were long GME saw significant gains.[63] Some investors that had been invested in the target stocks prior to the market events benefitted unexpectedly from the price rises,[64] while others, including quantitative and high-frequency hedge funds, joined the market rally to trade profitably.[65] Staff believes that hedge funds broadly were not significantly affected by investments in GME and other meme stocks. Staff did not observe that any advisers to private funds and registered funds experienced liquidity issues or difficulties with counterparties.

Yet while the swings in GME's share price and volume attracted significant attention, they were not unusual for January 2021. For instance, single-day price changes on January 27 from the closing prices on January 26 for KOSS (480.0%), AMC (301.2%), NAKD (252.3%), and Express, Inc. (symbol: EXPR) (214.1%) were larger than any single-day GME price change.[66] In fact, since 2020 began, 134 common stocks had at least one one-day price increase greater than GME's largest one-day price increase.[67]

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62 See, e.g., "'We got lucky': hedge funds that cashed in on the Reddit rally," Financial Times (February 17, 2021), available at https://www.ft.com/content/a883ad92-2fd8-454b-bc56-78b64ed20545; and "Melvin Capital, hedge fund targeted by Reddit board, closes out of GameStop short position," CNBC (January 27, 2021), available at https://www.cnbc.com/2021/01/27/hedge-fund-targeted-by-reddit-board-melvin-capital-closed-out-of-gamestop-short-position-tuesday.html.

63 See, e.g., "'We got lucky': hedge funds that cashed in on the Reddit rally," supra note 62; see also "This Hedge Fund Made $700 Million on GameStop," The Wall Street Journal (February 3, 2021), available at https://www.wsj.com/articles/this-hedge-fund-made-700-million-on-gamestop-11612390687.

64 See, e.g., "'We got lucky': hedge funds that cashed in on the Reddit rally," supra note 62.

65 See, e.g., "Hedge Funds Beat the Stock Market Thanks to the Gamestop Saga," Forbes (February 17, 2021), available at https://www.forbes.com/sites/jacobwolinsky/2021/02/17/hedge-funds-beat-the-stock-market-thanks-to-the-gamestop-saga/?sh=60ccf298791a (describing returns from one hedge fund index as compared to the broader stock market); see also "Glenview, Other Stock Funds Jump in January: Hedge Fund Update," Bloomberg (February 2, 2021), available at https://www.bloomberg.com/news/articles/2021-02-01/renaissance-quant-fund-slumps-9-5-in-january-stock-ructions (describing varying hedge fund performance in January).

66 Source: MIDAS vendor-supplied closing prices.

67 Id.

3.3 Impact on Exchange-Traded Funds

The market events of January 2021 also affected some exchange traded funds ("ETFs") and private funds. GME's volatility was significant enough to impact ETFs that held GME stock. For example, the SPDR® S&P® Retail ETF ("XRT") saw its position in GME increase from 1.5% of its portfolio as of December 31, 2020[68] to 19.98% of its portfolio on January 27, 2021.[69] That same day, XRT experienced net redemptions of $506 million, representing 76.3% of its net assets, which was the second largest net redemption in the fund's history. Over the three-day period ended January 28, 2021, XRT traded at an average bid-ask spread of $0.073, compared to a 52 week average bid-ask spread of $0.011.[70] In the same way, the Wedbush ETFMG Video Game Tech ETF ("GAMR") position in GME increased from 2.04% of its portfolio as of December 31, 2020 to as much as 17% of its portfolio on January 28, 2021. Over the three-day period ended January 28, 2021, GAMR traded at an average bid-ask spread of $1.32 compared to a 52 week average bid-ask spread of $0.186.[71] While this volatility raised questions about whether the market price of an impacted ETF's shares might decouple from the ETF's net asset value ("NAV"), staff observed that operations proceeded in a normal course for ETFs, despite heightened activity.[72] For example, XRT's closing price exhibited a premium of 1.25% to NAV on January 28, which is larger than its recent historical norms but does not seem

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68 See "SPDR® S&P® Retail ETF Semi-Annual Report," State Street Global Advisors SPDR, (December 31, 2020), available at https://www.ssga.com/us/en/institutional/etfs/resources/doc-viewer#xrt&semi-annual-report.

69 XRT seeks to track a modified equal weighted index where each of its holdings are roughly of similar size (as opposed to capitalization weighted where each holding's proportion of the portfolio is determined by the market value of the company). As GME's price increased, the size of the GME position held by XRT increased, as XRT did not rebalance its holdings during this time.

70 Source: Bloomberg.

71 Id. During periods of extraordinary volatility in the underlying ETF holdings, it may be difficult for authorized participants or market makers to confidently ascribe precise values to an ETF's holdings, thereby making it more difficult to effectively hedge their positions. Market participants might widen their quoted spreads in the ETF shares as a result.

72 ETFs do not sell or redeem individual shares. Instead, "authorized participants" purchase and redeem ETF shares directly from the ETF in blocks called "creation units" typically using a "basket" of securities and other assets identified by the ETF. The combination of the creation and redemption process with secondary market trading in ETF shares and underlying securities provides arbitrage opportunities that are designed to help keep the market price of ETF shares at or close to the NAV per share of the ETF. This arbitrage opportunity would exist if an ETF trades at a price that represents a premium (above) or a discount (below) its NAV.

indicative of a failure of the creation and redemption process or any other operational challenge beyond the observed volatility of its holdings.

3.4 Short Selling and Covering Short Positions[73]

GameStop at the time was notable for its significant short interest (the ratio of shares currently sold short to shares outstanding).[74] Figure 5 shows GME's short interest over time, along with average levels of short interest among other non-financial common stocks. In the past, GME had several periods of high short interest, but none as high as the levels achieved from 2019 to mid-January 2021. GME short interest hit 50% of shares outstanding first in 2012 and then again in 2015, 2016, and 2018, before rising even further in 2019. From then until early

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[73] Unless otherwise indicated, information in this subsection was derived from staff review of data maintained in the CAT database or obtained from Compustat, the Center for Research in Security Prices, LLC, ORTEX, and Bloomberg, as well as from the Nasdaq Stock Market LLC, New York Stock Exchange LLC, NYSE Arca, Inc., NYSE American LLC, and Cboe Exchange, Inc.

[74] Short selling involves the sale of a stock that the seller does not own. For example, if a stock has 100 shares outstanding and 5 of them are currently being sold short, then the stock would have short interest of 5%. Short selling is typically done: (1) when a person expects a stock to decline and borrows the stock from someone else to sell it at a current high price and later "cover" the sale by purchasing it at a lower price to give back to the lender; (2) by a market maker selling to a customer that wants to buy at a time when the firm does not have enough of the stock in its inventory to fill the customer's order; or (3) to hedge (i.e., reduce the economic exposure of) a long position in the same or a related security. Short selling is uniquely risky because stock prices can potentially rise indefinitely, in which case the short seller can lose more than the value of their original investment. Recognizing this risk, broker-dealers typically require that the short selling investor post collateral in a margin account of at least 50% of the shorted position in addition to the cash obtained from the short sale. Some issuers and individual investors have been vocal in their public criticisms of short selling. See, e.g., comments received in response to the Commission's proposed amendments to Regulation SHO, Securities Exchange Act Release No. 59748 (April 10, 2009), 74 FR 10842 (April 20, 2009), Comment File No. S7-08-09, available at: https://www.sec.gov/comments/s7-08-09/s70809.shtml. Nevertheless, short selling provides a financial incentive for individuals to uncover negative information (such as fraud), and can also act to dampen the boom/bust cycle, since shorts can reduce irrational exuberance when stocks are going up, and covering shorts acts as upward pressure on declining stocks. See, e.g., Vivian W. Fang, Allen H. Huang, and Jonathan M. Karpoff. "Short selling and earnings management: A controlled experiment." *The Journal of Finance* 71.3 (2016): 1251-1294, Robert F. Stambaugh, Yu Jianfeng, and Yu Yuan. "The short of it: Investor sentiment and anomalies." *Journal of Financial Economics* 104.2 (2012): 288-302.

2021, GME short interest hovered around 100%, hitting its high of 109.26% on December 31, 2020.

Some commentators have asked how short interest can get as high as it did in GameStop. Short interest can exceed 100%—as it did with GME—when the same shares are lent multiple times by successive purchasers. If someone purchases a stock from a short seller and subsequently lends the stock out again, it will appear as if the stock was sold short twice for the purpose of the short interest calculation.[75] Short interest ratios tend to be quite low; for large non-financial stocks, they are often less than 2.5% whereas for small non-financial stocks they still tend to be less than 13%. Few stocks, if any, have short interest greater than 50% on a given date.[76] Until recently, short interest of more than 90% was observed only a few times—in 2007 and 2008. When examining short interest as a percent of shares outstanding, GME is the only stock that staff observed as having short interest of more than shares outstanding in January 2021.

Given the high levels of short interest, together with the price movements in GameStop, a natural question is the degree to which these price movements arose from a "short squeeze." Indeed, some of the meme stock trading was described in news coverage as an act of rebellion against short-selling professional investors who had targeted GameStop and other stocks. A short squeeze might occur when an event triggers short sellers *en masse* to purchase shares to cover their short positions. For example, if there is a sudden increase in the price of the stock being shorted, short sellers would face margin calls requiring them either to post additional collateral or to exit their position. Short sellers that cover their positions by buying the underlying stock would cause additional upward price pressure on the stock, which could force other short sellers to exit their positions, adding further upward price pressure and so on. Because short sellers are out of the market, at least temporarily, a stock price could continue to rise, unchecked by those who are pessimistic regarding its performance. Further, because short sellers could lose more than the capital they have invested, the extreme risk could deter further short selling in the stock. While the price of GameStop did eventually fall, one could ask to what extent a short squeeze lay behind its price increase dynamics.

In seeking to answer this question, staff observed that during some discrete periods, GME had sharp price increases concurrently with known major short sellers covering their short positions after incurring significant losses. During these times, short sellers covering their positions likely contributed to increases in GME's price. For example, staff observed that

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75 Suppose that a stock has 100 shares outstanding and one is sold short. The stock will have a short interest ratio of 1%. If the individual who purchases the share from the short seller then lends it out, there will be two investors with a short position based on the same share. That is, there will be one share sold short twice, and so short interest will be 2%, even though 99 of the 100 shares are not being sold short. If this process occurs enough times, then short interest can exceed 100%.

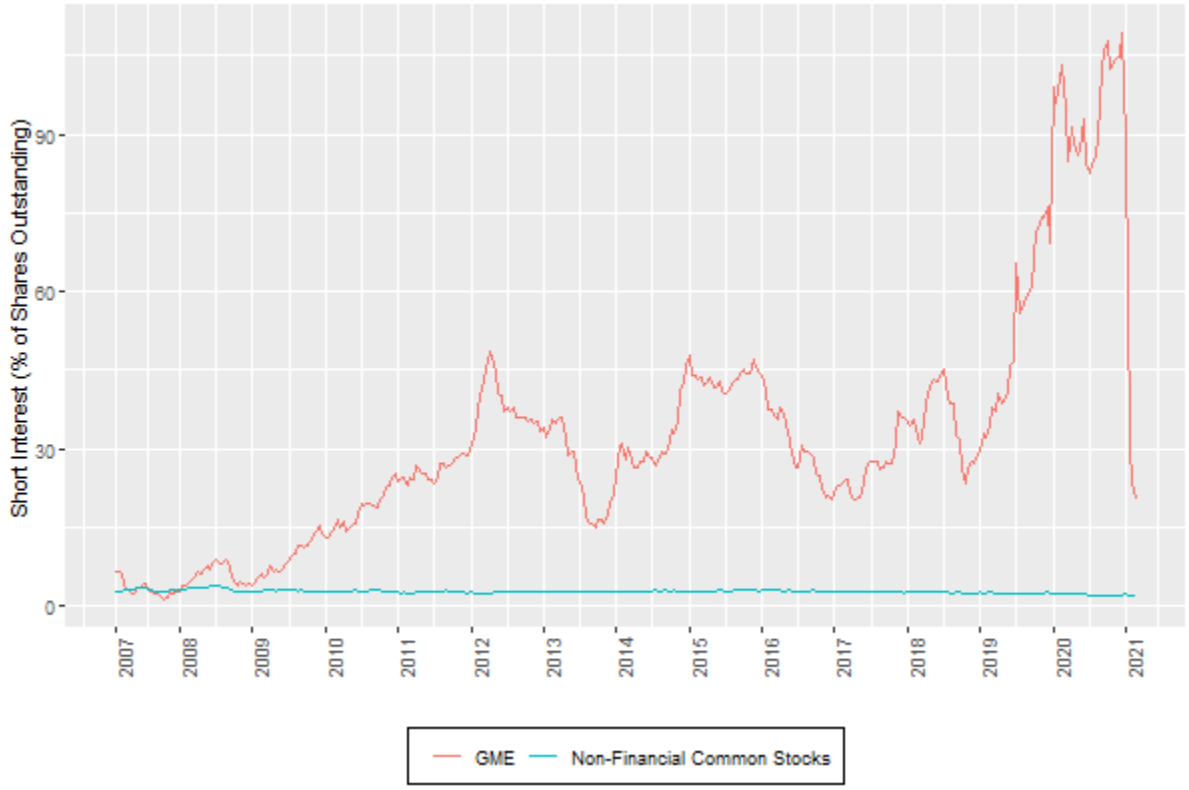
76 For example, during the significant market turbulence in 2008, 12 stocks had short interest of more than 50% on a single record date.

particularly during the earlier rise from January 22 to 27 the price of GME rose as the short interest decreased. Staff also observed discrete periods of sharp price increases during which accounts held by firms known to the staff to be covering short interest in GME were actively buying large volumes of GME shares, in some cases accounting for very significant portions of the net buying pressure during a period. Figure 6 shows that buy volume in GME, including buy volume from participants identified as having large short positions, increased significantly beginning around January 22 and remained high for several days, corresponding to the beginning of the most dramatic phase of the run-up in GME's price.

Figure 6 shows that the run-up in GME stock price coincided with buying by those with short positions. However, it also shows that such buying was a small fraction of overall buy volume, and that GME share prices continued to be high after the direct effects of covering short positions would have waned. The underlying motivation of such buy volume cannot be determined; perhaps it was motivated by the desire to maintain a short squeeze. Whether driven by a desire to squeeze short sellers and thus to profit from the resultant rise in price, or by belief in the fundamentals of GameStop, it was the positive sentiment, not the buying-to-cover, that sustained the weeks-long price appreciation of GameStop stock.

Figure 5

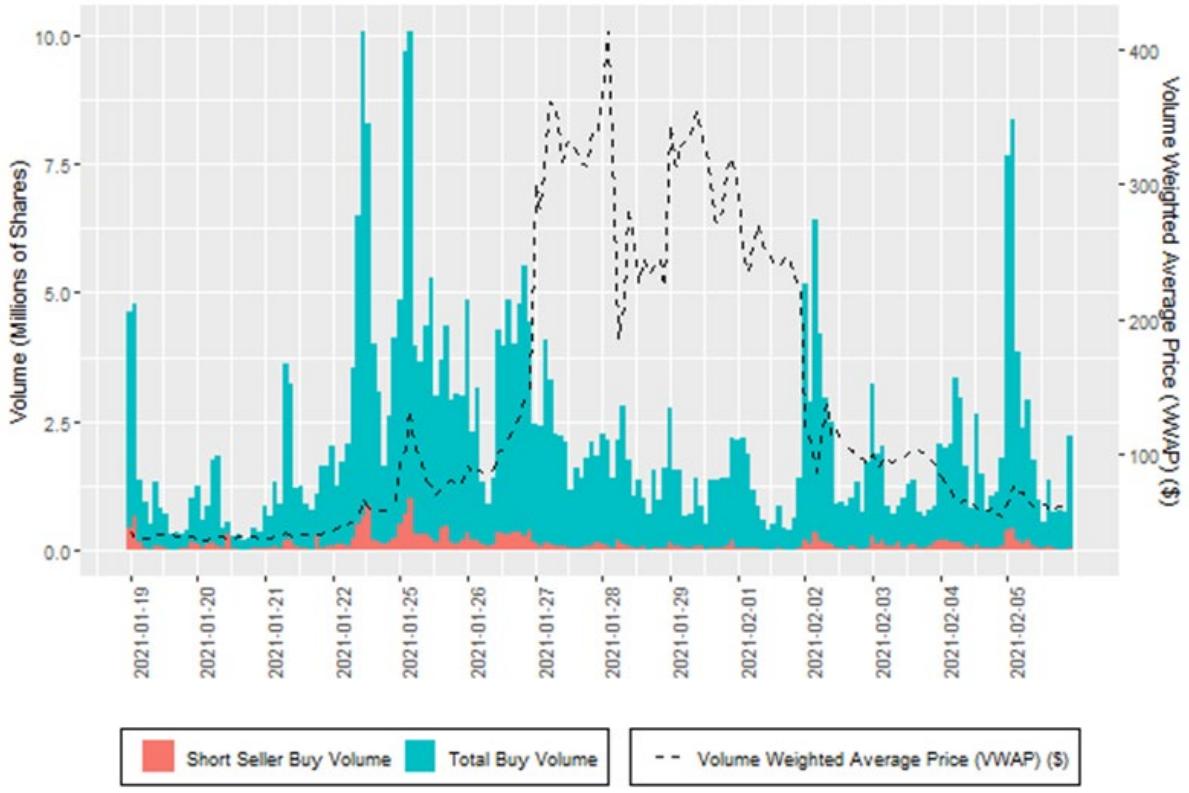
Short Interest in GameStop vs. Market, Jan. 2007 – Feb. 2021[77]



[77] This figure captures the short interest ratio for GME as compared to the weighted average short interest ratio for other non-financial common stocks for the period from January 2007 to February 2021. We estimate the short interest ratio for each stock as the number of shares in short interest reported by the exchanges on a bi-weekly basis and obtained from the Compustat North America Supplemental Short Interest File (for NYSE- and Nasdaq-listed stocks), divided by shares outstanding obtained from the Center for Research in Security Prices, LLC (CRSP) daily stock files. Since short interest is reported as of the settlement date, we match short interest to the trading date two days prior to the short interest report date. The sample includes non-financial (i.e., excluding stocks with SIC code between 6000 and 6999), common (i.e., CRSP share code of 10 or 11) common stocks. Following Blocher & Ringgenberg (2019), we exclude stocks whose short interest ratio and adjusted short interest ratio (where the adjusted short ratio is adjusted for stock splits, buybacks, etc.) differ by more than 10%, in order to exclude potential asynchronous adjustments for stock splits in the shares outstanding and short interest datasets. Further, stock-date observations for which a stock has multiple *gvkey*'s (Compustat identifier) or *permno*'s (CRSP identifier) per date are removed. For the group of non-financial common stocks, we take the value-weighted average short interest ratio within a group, using market capitalization as weights. Market capitalization is calculated as shares outstanding multiplied by the closing price (obtained from the CRSP daily stock files) two days prior to the short interest record date.

Figure 6

Buying Activity of Traders with Large Short Positions in GameStop, Jan. 19 – Feb. 5, 2021[78]



See Blocher, Jesse and Ringgenberg, Matthew C., Short Covering (February 11, 2019), available at: https://ssrn.com/abstract=2634579.

78 This figure shows the total buy volume during half-hour intervals from January 19 to February 5, 2021, of traders identified as having a large short position in GME, along with total buy volume and the value-weighted average stock price, using data from CAT. We identify traders with large short positions by first calculating traders' average inventory positions as of January 15, 2021, and isolating the Firm Designated IDs ("FDIDs") with an average negative position, excluding market makers and high frequency traders (i.e., identified as traders that offset their trades within a day). We then isolate the FDIDs with negative inventories below (i.e., more negative than) the median as our sample of heavily shorted traders. We then identify the buy trades initiated by these FDIDs over the next two weeks (January 19 – February 5). Note that since the CAT sample only begins on December 24, 2020, we are not able to include FDIDs' inventory positions accumulated prior to this date. Value-weighted average stock prices are obtained from TAQ.

Another possible explanation could be a "gamma squeeze," which occurs when market makers purchase a stock to hedge the risk associated with writing call options on that stock, in turn putting further upward pressure on the underlying stock price. As noted above, though, staff did not find evidence of a gamma squeeze in GME during January 2021. One of the main drivers of a gamma squeeze is an influx of call option purchases, which causes market makers to hedge their writing of the call options by purchasing the underlying stock, driving up the stock price in the process. While staff did find GME options trading volume from individual customers increased substantially, from only $58.5 million on January 21 to $563.4 million on January 22 until peaking at $2.4 billion on January 27, this increase in options trading volume was mostly driven by an increase in the buying of put, rather than call, options. Further, data show that market-makers were buying, rather than writing, call options. These observations by themselves are not consistent with a gamma squeeze.

The unusually high amount of short selling raised the question of whether some of the short sales were "naked"—namely, made without arranging to borrow the underlying security.[79] When a naked short sale occurs, the seller fails to deliver the securities to the buyer,[80] and staff did observe spikes in fails to deliver in GME. However, fails to deliver can occur either with short or long sales, making them an imperfect measure of naked short selling. Moreover, based on the staff's review of the available data, GME did not experience persistent fails to deliver at the individual clearing member level. Specifically, staff observed that most clearing members were able to clear any fails relatively quickly, i.e., within a few days, and for the most part did not experience fails across multiple days.[81]

Finally, as discussed above, the volatility in GME impacted some ETFs due to their holdings in GME, and potential short interest in the ETFs themselves. The most notable of these was XRT, an ETF of retail companies. XRT garnered attention in the press and on Reddit due to a combination of its GME exposure and its pre-existing short interest, which was several

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79 In a "naked" short sale, the seller does not borrow or arrange to borrow the securities in time to make delivery to the buyer within the standard two-day settlement period. As a result, the seller fails to deliver securities to the buyer when delivery is due. Because direct measures of naked short selling do not exist, fails to deliver can be used to learn about naked short selling. Naked short selling can have negative effects on the market. For example, fraudsters may use naked short selling as a tool to manipulate the market, which is illegal. In this regard, the Commission in 2008 adopted Rule 10b-21, a naked short selling antifraud rule.

80 A "fail to deliver" or "fail" is when the seller fails to deliver securities to the buyer when delivery is due. Short selling has long been subject to regulation in this regard. For instance, Regulation SHO requires broker-dealers to properly mark sale orders as "long" or "short" (Regulation SHO Rule 200), to locate a source of shares prior to effecting a short sale (also known as the "locate" requirement in Regulation SHO Rule 203), and to close out fails to deliver that result from long or short sales (Regulation SHO Rule 204).

81 Staff conducted this analysis using data provided by the NSCC.

multiples of XRT's shares outstanding.[82] As GME increased in value, price changes in XRT became increasingly driven by those of GME. Shorting XRT could have served as an indirect, though imperfect, way of shorting GME. In fact, staff observed a large spike in net redemptions of nearly 6 million shares in XRT on January 27, which may be consistent with short selling activity.[83] This redemption activity was generated nearly entirely by ETF market making firms. It therefore was likely the result of net selling of XRT by market participants against market makers (e.g., market makers buying from investors selling short) where the market makers, rather than offsetting those purchases, subsequently redeemed the XRT shares from the ETF sponsor for shares of the underlying stocks. Such shorting could have led XRT to trade either at a premium or discount relative to its NAV depending on market dynamics. As noted above, XRT's closing price exhibited a premium of 1.25% to NAV on January 28, which is larger than its recent historical norms but does not seem indicative of a failure of the creation and redemption process or any other operational challenge beyond the observed volatility of its holdings. It is noteworthy, therefore, that the price of XRT remained close to its NAV during this period. Differential costs of shorting were insufficient to overcome the ability to arbitrage the price/NAV differential, as the creation and redemption process through authorized participants continued to function, which helped keep the ETF's share price close to its NAV.

The price surge in GME also raises questions of market efficiency that relate to short selling. Staff have observed that it was unusually costly to borrow shares in GME.[84] Academic research implicates constraints on short selling as a possible contributor to bubbles where stock prices rise above what may be justified by fundamentals.[85] Such constraints on short selling could arise from cost or from risk aversion. To the extent that GameStop was costly and risky to short, the reluctance to sell short could have contributed to the run-up in prices and the subsequent steep decline. While a short squeeze did not appear to be the main driver of events,

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82 See, e.g., "The most shorted securities in the world aren't stocks," Quartz (February 5, 2021), available at: https://qz.com/1968231/retail-etf-with-highest-short-interest-was-blown-up-by-gamestop/; and "Investors dump State Street ETF after GameStop weighting surges," Financial Times (January 28, 2021), available at: https://www.ft.com/content/3d9c8383-a083-44a3-9c7e-54bb36c95a51.

83 Staff derived this information using data provided by the NSCC.

84 Even when a share can be borrowed, short sellers may find it costly to borrow stock to enter or maintain a short position. This cost is known as a securities lending fee, or simply a "lending fee." During the second quarter of 2020, the cost to borrow GME was greater than 100%. This is an exceptionally high cost to borrow. Cost to borrow GME declined to under 50% by June 2020. For perspective, between January 2007 and July 2018, the securities of just 222 firms had lending fees greater than 100% at any point, accounting for just 0.01% of observations. Average lending fees were 1.5% during that same period. Lending fees to borrow GME were around 25% in January 2021 and fell as short interest began to decline into February 2021.

85 See Harrison and Kreps, 1978, "Speculative Investor Behavior in a Stock Market with Heterogeneous Expectations," Quarterly Journal of Economics 92, 323-36.

and a gamma squeeze less likely, the episode highlights the role and potential impact of short selling and short covering.

3.5 Clearing Agency Margin and Capital Issues

Clearing agencies (i.e., NSCC and, to a lesser extent, OCC) played important roles during the January 2021 GME market events. The risk management mechanisms of these clearing agencies effectively led others in the transaction chain—such as retail broker-dealers—to pause and manage the risk exposure that arose as the rate of transactions accelerated. Both NSCC and OCC experienced record volumes cleared on January 27, 2021. After the market events of late January 2021, both NSCC's and OCC's margin requirements returned to prior and more historically consistent levels.

As mentioned above, in highly volatile trading where share prices whipsaw by hundreds of dollars, NSCC may require more margin to guard against an increased risk of defaults (which may occur if, for example, buyers do not carry-through on paying for a stock that has plummeted or sellers do not carry-through on delivering a stock that has skyrocketed). On January 27, 2021, in response to market activity during the trading session, NSCC made intraday margin calls from 36 clearing members totaling $6.9 billion, bringing the total required margin across all members to $25.5 billion. Of the $6.9 billion, $2.1 billion were intraday mark-to-market calls, while the remaining $4.8 billion was a special ECP charge. Specifically, NSCC observed unusual volatility in certain securities, including GME, which presented heightened risk to the clearinghouse and its members.[86] As a result, it calculated and assessed against certain affected members the remaining $4.8 billion as an additional special charge pursuant to its established rules. NSCC imposed this charge on 18 members, all of whom provided the additional margin. NSCC subjected one additional member to the special charge, but that member ultimately did not have to meet that charge after offsetting its exposure with a transfer from an affiliate.

In addition, several NSCC members were subject to an ECP charge based on the ratio of the excess risk in their portfolios relative to their capital. Because these members' ratios of excess risk versus capital were not driven by individual clearing member actions, but by extreme volatility in individual cleared equities, NSCC exercised its rules-based discretion to waive the ECP charge for all members on January 28, 2021. Absent this waiver, one retail broker-dealer would have had an additional ECP charge of more than double its margin requirement of $1.4 billion on January 28, 2021. NSCC removed this waiver on February 2, 2021, meaning that any

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86 See Letter from Michael C. Bodson, President and Chief Executive Officer of DTCC, to the Honorable Patrick McHenry, Ranking Member on the Committee on Financial Services for the U.S. House of Representatives, dated February 18, 2021, available at: https://www.dtcc.com/-/media/Files/PDFs/DTCC-Statement-February-2021-Mike-Bodson.pdf.

member whose ratio of excess risk versus capital incurred an ECP charge would have been obligated to pay the charge going forward.

OCC margin requirements followed a similar pattern to those at NSCC, although OCC did not take any non-routine actions to increase financial resources during this period.

NSCC, like most similar central counterparties, does not instruct its member firms to stop trading or clearing individual symbols because its rules do not give it that ability. However, as discussed below, some broker-dealers restricted activities in a limited number of individual stocks in reaction to margin calls and capital charges imposed by NSCC. This would be a decision made by the broker-dealers and not directed by NSCC.

3.6 Broker-Dealer Reactions and Trading Restrictions

In their customer account agreements, some broker-dealers reserve the right to decline customer orders or cancel trades without prior notice. Such actions could be taken, for example, for legal, compliance, or risk management reasons.[87] As GME and other meme stocks experienced increased levels of volatility, some broker-dealers with a largely individual investor customer base restricted some types of trading[88] by their customers in those stocks.[89]

One narrative at the time attributed the broker-dealer trading restrictions to pressure from hedge funds and their commercial partners (e.g., the wholesalers and consolidators) for the

87 See, e.g., "Thinking About Investing in the Latest Hot Stock?," SEC Office of Investor Education and Advocacy (January 30, 2021), available at: https://www.sec.gov/oiea/investor-alerts-and-bulletins/risks-short-term-trading-based-social-media-investor-alert.

88 For example, Robinhood and Interactive Brokers stated that in some cases, investors would only be able to sell their position in certain securities and not open a new position. See, e.g., "Robinhood restricts trading in GameStop, other names involved in frenzy," CNBC (January 28, 2021), available at: https://www.cnbc.com/2021/01/28/robinhood-interactive-brokers-restrict-trading-in-gamestop-s.html.

89 See, e.g., "Robinhood, Other Brokerages Restrict Trading on GameStop, AMC," The Wall Street Journal (January 28, 2021), available at: https://www.wsj.com/articles/online-brokerages-restrict-trading-on-gamestop-amc-amid-frenetic-trading-11611849934.

restrictions.[90] This narrative was the subject of testimony at a Congressional hearing,[91] where witnesses testified that the trading restrictions did not result from such pressure.[92] Instead, some of the impacted broker-dealers maintained that the trading restrictions were a reaction to margin calls and capital charges imposed by NSCC in response to the extraordinary volatility in GME and other stocks.[93]

The actions of one broker-dealer help illustrate what happened. The staff observed that, on January 26, 2021, one broker-dealer began increasing both initial and maintenance margin

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90 See, e.g., "BarStool's Dave Portnoy, Mets' Steve Cohen Spar Over Gamestop Drama," Fox Business (January 28, 2021), available at: https://www.foxbusiness.com/sports/barstools-dave-portnoy-mets-steve-cohen-gamestop; "Robinhood CEO refutes 'conspiracy theory' that hedge funds prompted GameStop trading halt," Fox Business (January 30, 2021), available at: https://www.foxbusiness.com/markets/robinhood-ceo-refutes-conspiracy-theory-hedge-funds-prompted-gamestop-trading-halt.

91 See, e.g., "Robinhood CEO Testifies: 'We Don't Answer to Hedge Funds,'" ThinkAdvisor (February 18, 2021), available at: https://www.thinkadvisor.com/2021/02/18/robinhood-ceo-testifies-we-do-not-answer-to-hedge-funds/.

92 See, e.g., Testimony of Vladimir Tenev, Co-Founder and CEO of Robinhood Markets, Inc., ("Robinhood did not impose these trading restrictions at the request of hedge funds or to try and move prices in GameStop one way or the other."), at Sec. VIII, n.20, Hearing Before the U.S. House Committee on Financial Services ("HCFS")(February 18, 2021), available at: https://financialservices.house.gov/uploadedfiles/hhrg-117-ba00-wstate-tenevv-20210218.pdf; Testimony of Gabriel Plotkin, Founder and Chief Investment Officer, Melvin Capital Management, ("I want to make clear at the outset that Melvin Capital played absolutely no role in those trading platforms' decisions [to limit trading in GameStop]."), Hearing Before the HCFS (February 18, 2021), available at: https://financialservices.house.gov/uploadedfiles/hhrg-117-ba00-wstate-plotking-20210218.pdf; Testimony of Kenneth C. Griffin, Founder and CEO of Citadel and Founder and Principal Shareholder of Citadel Securities, ("I want to be perfectly clear: we had no role in Robinhood's decision to limit trading in GameStop or any other of the 'meme' stocks."), Before the HCFS (February 18, 2021), available at: https://financialservices.house.gov/uploadedfiles/hhrg-117-ba00-wstate-griffink-20210218.pdf.

93 See, e.g., "Robinhood says restrictions on GameStop due to tenfold increase in clearinghouse deposit requirements," CNBC (January 30, 2011), available at: https://www.cnbc.com/2021/01/30/robinhood-says-restrictions-on-gamestop-due-to-tenfold-increase-in-deposit-requirements.html; and Robinhood Markets, Inc., Registration Statement (S-1) (July 1, 2021) ("from January 28 to February 5, 2021, due to increased deposit requirements imposed on [Robinhood's affiliated clearing broker] by NSCC in response to unprecedented market volatility, particularly in certain securities, we temporarily prevented our customers from purchasing certain specified securities,

requirements in customer margin accounts holding GME. Margin requirements began at 80% and then increased to 100% the following day.[94] This firm also reduced the trade limit on GME option contracts from 5,000 contracts to 3,000 contracts per customer. The next day, the firm first limited GME option contracts to 300 and later reduced it again to 100 contracts. On January 28, the firm stated that it would restrict all new customer purchases in eight securities—AMC; BlackBerry Ltd.; BBBY; EXPR; GME; KOSS; NAKD; and Nokia Corp.— and place them in position closing only ("PCO") status.[95] On January 29, the firm stated that it would lift the PCO status and implement a series of limits on the amount of shares its customers could hold in both equity securities and options in a number of securities ("restricted securities"). The firm made adjustments throughout the day. At one point, on January 29, the firm's list of restricted securities grew to over 50 names. In addition to these position limits, the firm stated that it was no longer permitting fractional share purchases in restricted securities. The firm said it would only allow new whole share positions, subject to the position limits, in the restricted securities. According to the firm, customers owning existing fractional shares in restricted securities were only able to sell or close their positions. The firm said it eased the limits over the next week and removed them entirely on February 5, 2021.

Some broker-dealers temporarily restricted trading for stated reasons they did not explicitly or publicly attribute to NSCC margin. For example, on January 28, one such firm stated that it restricted purchases in GME and AMC for its customers and required customers to post additional margin for one day only.[96]

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including GameStop Corp. and AMC Entertainment Holdings, Inc., on our trading platform").

94 "Initial margin" is a percentage of the purchase price of a security that must be covered by cash or collateral when using a margin account. Pursuant to Regulation T, a customer cannot purchase more than 50% of the security using borrowed funds. "Maintenance margin" is the additional funds required if a security's price goes in the opposite direction of the initial margin transaction. The account must maintain equity of at least 25%, as set forth in FINRA Rule 4210(c). If a security price drops by more than 25%, the customer will receive a margin call from the firm requesting additional money. However, depending on various factors, the broker-dealer may sell out of any position in the customer's account in order to meet the margin call without requiring the customer's consent, as it is typically included in the customer agreement at account opening. The amount by which equity in a margin account exceeds the required margin is referred to as "maintenance margin excess."

95 On January 28, 2021, a clearing broker-dealer that services other broker-dealers also instructed its customer broker-dealers (other broker-dealers that have customer accounts) to temporarily restrict new purchases in AMC, GME, and KOSS. This firm represented that it removed the trading restrictions on its customer broker-dealers later that day starting at 2:55 p.m.

96 The imposition of additional margin by a broker-dealer to its customers is separate from NSCC margin or capital charges imposed on the NSCC member broker-dealer.

Other broker-dealers restricted trading due to capacity issues. For example, one firm's system created a unique ID for each order, but purportedly reached a limit in the number of unique IDs it was able to create on January 27, 2021.[97] The following day, January 28, when the firm realized that it would likely run out of unique IDs again, it restricted customers from making new purchases of shares of GME and AMC and from opening option positions in these stocks during the last one and a half hours of the trading day. Customers were still permitted to close their existing long or short GME and AMC positions, and the restriction was lifted before the market opened on January 29.

The staff also observed differing practices among broker-dealers when notifying customers about trading restrictions. Some broker-dealers notified customers when they imposed trading restrictions through various methods including emails, pop-up messages when accessing the account or trying to transact in a security that was restricted, posts on dedicated customer service sections of the platform, and social media posts.

3.7 Role of Off-Exchange Market Makers

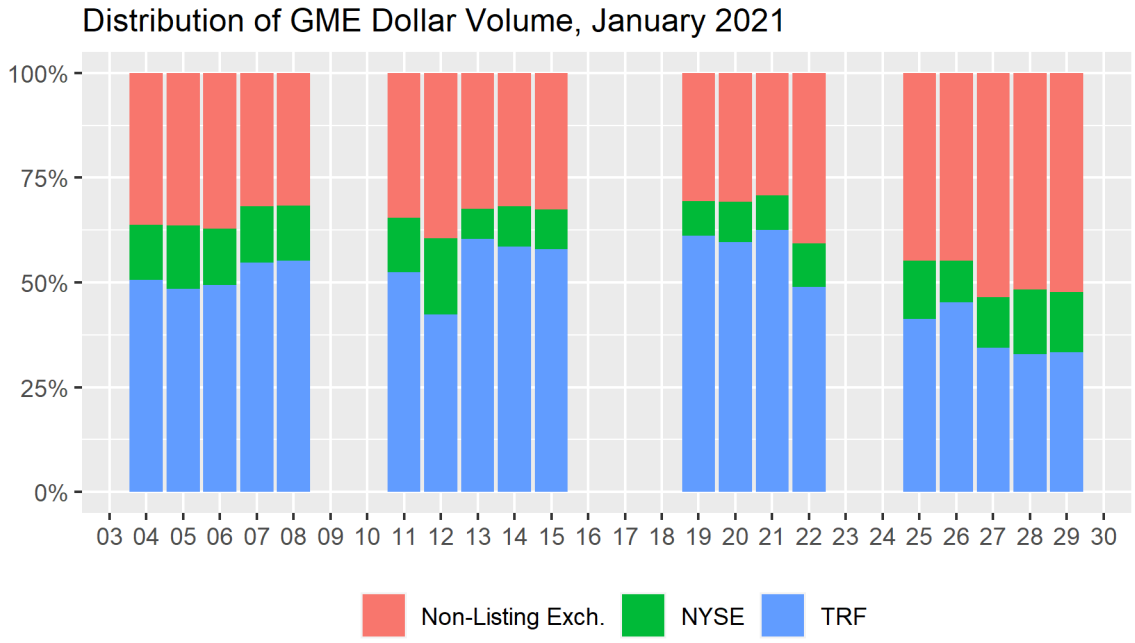
GME trading in January 2021 shifted the prevailing distribution of GME equity executions across venues. Specifically, the proportion of off-exchange activity initially rose as individual investor activity increased, then fell as volatility increased. Approximately half of GME's dollar and share volume reported to the consolidated tape in 2020 was executed on a national securities exchange. On January 21, 2021 (when GME opened at $39.23 and closed at $43.03), 62.60% of the day's dollar volume was executed off exchange. But, beginning on January 22 (when GME opened at $42.59 and closed at $65.01), the percentage of dollar volume executed off exchange consistently dipped below 50%, reaching a low of 32.83% on January 28 (when GME opened at $265.00 and closed at $193.60).

An increasing percentage of volume executed on exchange when volatility spikes may indicate that market participants, including wholesalers, are seeking to avoid internalizing customer orders to reduce potential losses when hedging becomes more difficult.

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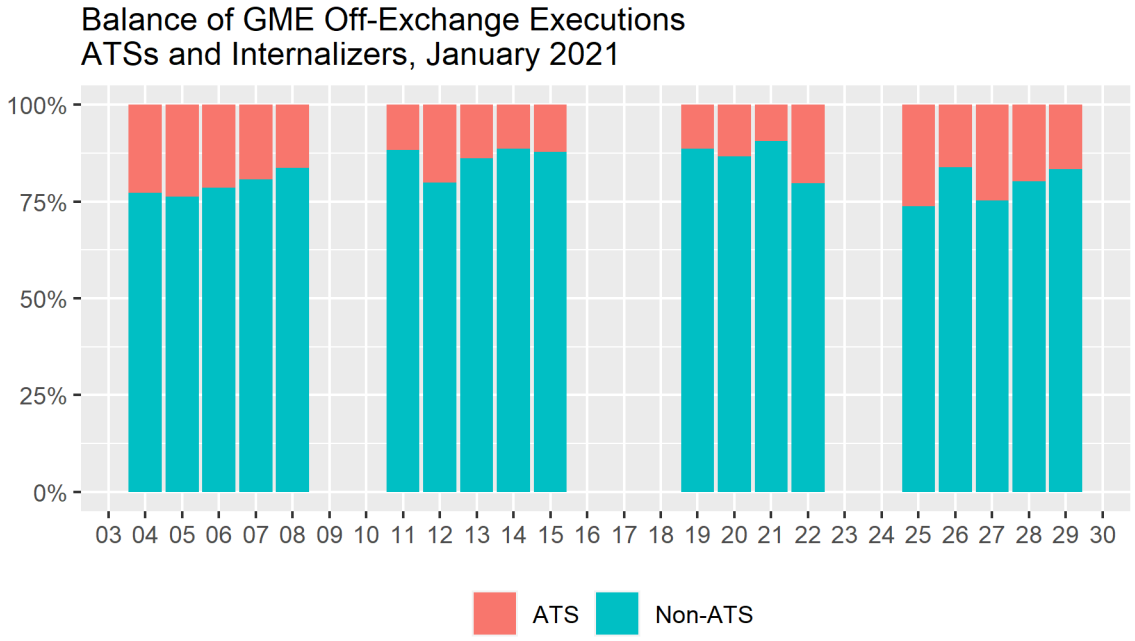
97 The firm's average daily trading volume in 2019 was approximately 300,000 trades per day. In January 2021, the firm handled around 1.6 million trades per day. During the week of January 25, 2021, the firm's daily trading volume hit record highs in three of the five trading days. GME and AMC were the largest drivers of that elevated customer volume in January 2021.

Figure 7[98]



Source: NYSE TAQ

Figure 8



Source: Consolidated Audit Trail

98 "TRF" refers to the Trade Reporting Facility for the reporting of transactions effected otherwise than on an exchange.

The vast majority of GME stock trades executed off exchange in January 2021 were internalized (approximately 80%) as opposed to executed on ATSs.[99] The market for internalization of GME was highly concentrated, with 88% of internalized dollar volume in January executed by just three wholesalers.[100] Citadel Securities accounted for nearly 50% of internalizer dollar volume during the month, rising to as high as 55% of daily internalized dollar volume twice.[101] Virtu Americas accounted for approximately 26% of the internalized volume during January.[102] While the percentage of GME trading internalized declined during the last week in January, the absolute volumes executed by internalizing firms during the days of the most intense trading in this period were, in some cases, an order of magnitude larger than what had previously been typical for these firms. For example, Citadel internalized an average of just under $37 million of GME per day in December 2020.[103] On January 27, Citadel internalized nearly $4.2 billion of GME.[104] Similarly, Virtu internalized an average of $23.4 million of GME each day in December 2020 and $2.2 billion of GME on January 26.[105] On January 29, Citadel internalized approximately $2.2 billion of GME stock, while Virtu internalized approximately $1.4 billion.[106]

3.8 Available Liquidity for GME

To better understand the market for GameStop's equities and options during January 2021, it is important to look beyond the volatility in GME's share price. While volatility, price, and volume increased dramatically in the last two weeks of January, market participants also experienced multiple volatility-induced trading disruptions and deteriorations in some measures of liquidity.

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99 Source: Consolidated Audit Trail. The attribution of off-exchange volumes in this section, derived from reports of off-exchange executions in the Consolidated Audit Trail, follows the approach in the public FINRA OTC Transparency data. See https://otctransparency.finra.org/otctransparency/. Attributions of executed volume reflect the firms with the obligation to report each off-exchange trade to a Trade Reporting Facility (generally the executing broker-dealer), so only show the firm involved on one side of each trade.

100 Source: Consolidated Audit Trail.

101 Id.

102 Id. G1 Execution Services (owned by Susquehanna International Group LLP) accounted for approximately 12% of the internalized dollar volume in GME during January 2021.

103 Id.

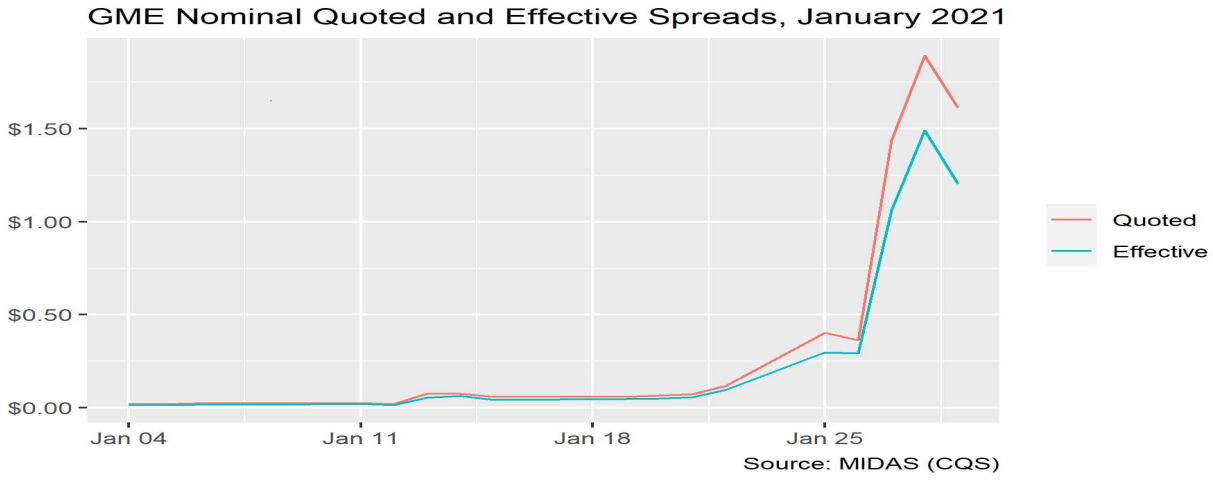
104 Id.

105 Id.

106 Id.

Consistent with increased volatility in GME, various measures of liquidity declined substantially during January 2021.[107] As shown in Figure 9 below, bid-ask spreads widened significantly for GME in January 2021. For example, on January 28, 2021, the daily average relative effective spread for GME stock was 0.54%, three times the average of 0.18% for 2020.[108] Nominal quoted spreads for GME stock were nearly 50 times larger than the 2020 daily average.[109]

Figure 9



The size of the best priced quotes in GME stock also decreased as the share price of GME increased. During the first eight months of 2020, the average daily median size at the best bid was 4,720 shares.[110] In contrast, on January 29, 2021, when GME opened at $379.71 (up from the prior day's close at $193.60), the median size at the best bid was only 19 shares. However, other measures of depth in GME remained relatively robust. Measured in dollar value, the notional value (i.e., share price times number of shares quoted) of GME's inside depth at the best bid and ask prices did not fluctuate as dramatically during January 2021,[111] signifying that liquidity providers continued to commit capital to quoting GME, albeit with fewer shares as the

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107 As volatility increases, market prices are increasingly likely to experience material fluctuations. As a result, liquidity providers generally would be expected to be more conservative in providing liquidity as they attempt to limit the risk of incurring losses.

108 Source: Consolidated Quote System (MIDAS).

109 Id.

110 Source: Exchange proprietary data feeds (MIDAS).

111 Id.

share price dramatically increased. Further, as the proportion of volume in GME shifted to exchanges at the end of the month, the dollar value of displayed inside liquidity increased.[112]

As extreme intraday volatility in GME occurred, exchanges' Limit-Up, Limit-Down ("LULD") trading pauses were triggered on six trading days in late January. LULD is a trading mechanism that attempts to address extraordinary volatility in stocks. If either the National Best Bid equals the stock's upper bound or the National Best Offer equals the stock's lower bound for fifteen seconds, the stock's trading will be paused for five minutes.[113] Significant price movement in GME during January 2021 triggered 40 LULD pauses, compared with only one in all of 2020.[114] On January 28 alone, 19 LULD pauses were triggered in GME.[115]

Table 1 *Count of LULD Pauses in GME, Late January 2021*[116]

Date	Down	Up
2021-01-22	1	2
2021-01-25	8	1
2021-01-26	3	2
2021-01-27	3	0
2021-01-28	13	6
2021-01-29	1	0

Source: NYSE TAQ

112 Id. In addition to a larger proportion of the volume in GME trading on exchanges, the increase in the dollar value of displayed inside liquidity may also have resulted from the increase in GME's price.

113 LULD pauses are triggered when the price of a stock falls outside of a specified price band. Price bands are set at a percentage above and below a "reference price," which is an arithmetic mean of certain reported transactions in the stock over the previous five minutes. The percentage above and below the reference price differs based on the type of stock, the price of the stock, and the time of day.

114 Source: NYSE TAQ.

115 Id. Trading in GME also triggered two short sale circuit breakers on January 15 and January 28. Id. A short sale circuit breaker is triggered when a stock has declined 10% or more relative to the previous day's closing price. When triggered, this mechanism imposes restrictions that last for the remainder of the day and the following day, during which short sale orders generally may not be executed or displayed at a price that is less than or equal to the current National Best Bid. See Rule 201 of Regulation SHO.

116 January 23, 24, 30, and 31 were weekends.

3.9 GME Options Trading

Consistent with the trading activity in GME stock, trading in GME options increased significantly in January 2021. From the beginning of 2020 through September of that year, GME options traded a median of about 16,000 contracts per day, with a maximum of about 172,000 in one day, with a median dollar volume totaling just over $800,000 per day and a maximum of about $42 million in one day. In the fourth quarter of 2020, GME options traded a median of about 84,000 contracts per day, with a maximum of about 560,000 in one day, with a median dollar volume totaling approximately $10.5 million per day and a maximum of about $120 million in one day. On January 27, 2021, as shown in Figures 10 and 11, below, over 2 million contracts traded, worth over $8 billion.

Figure 10

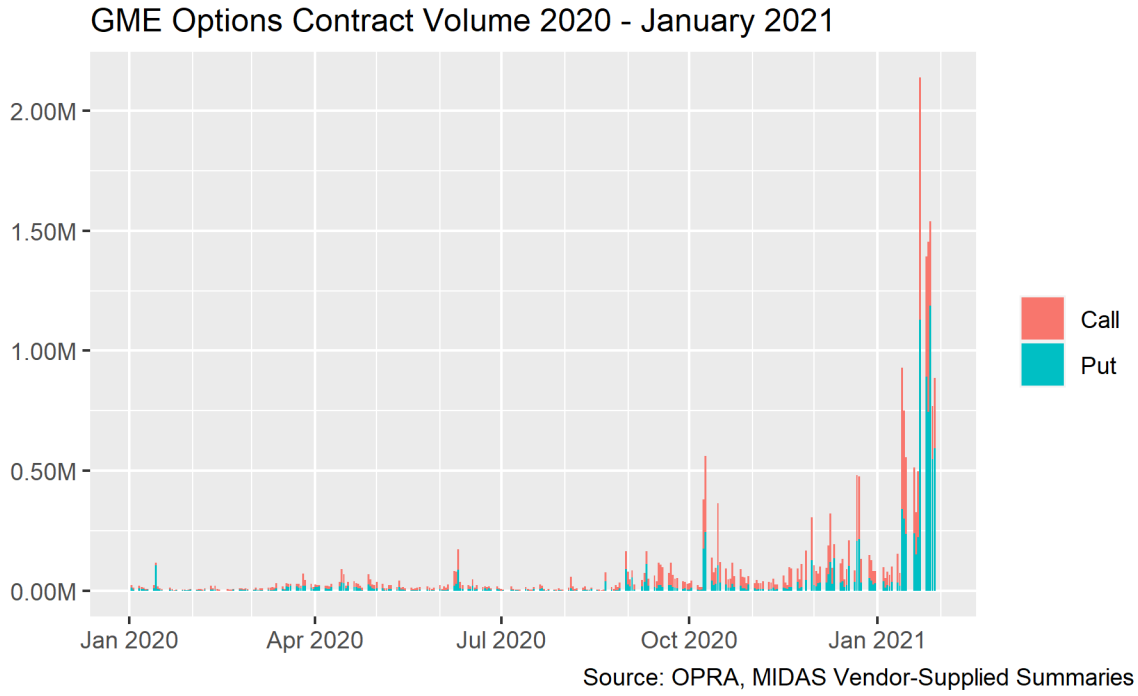


Figure 11

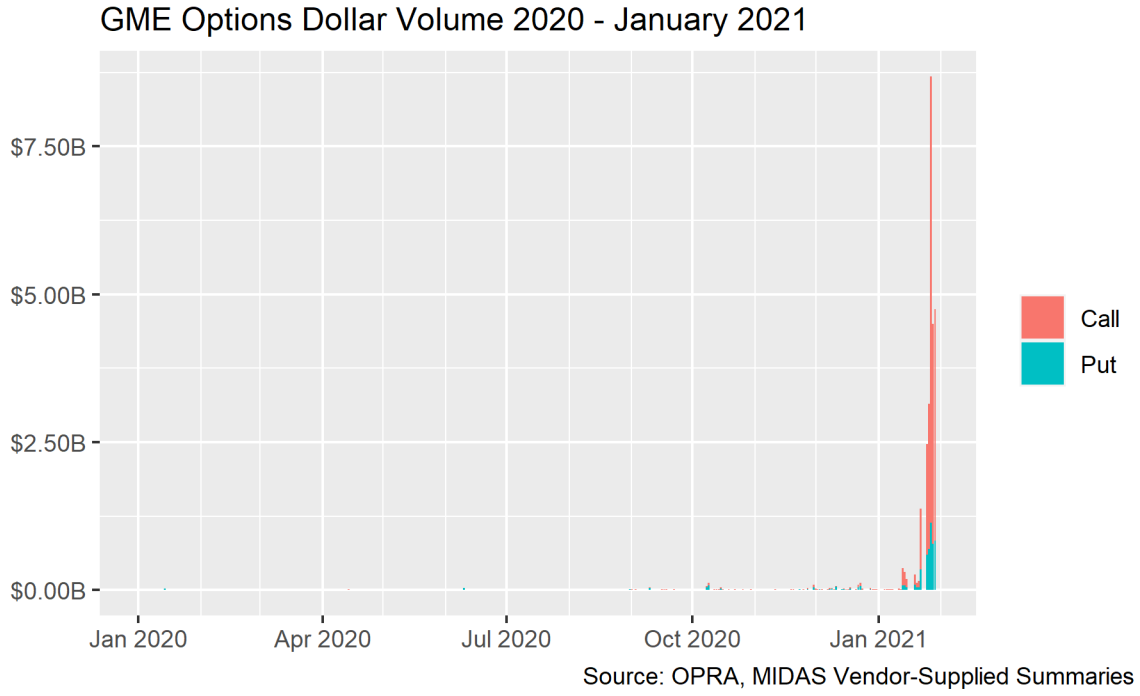
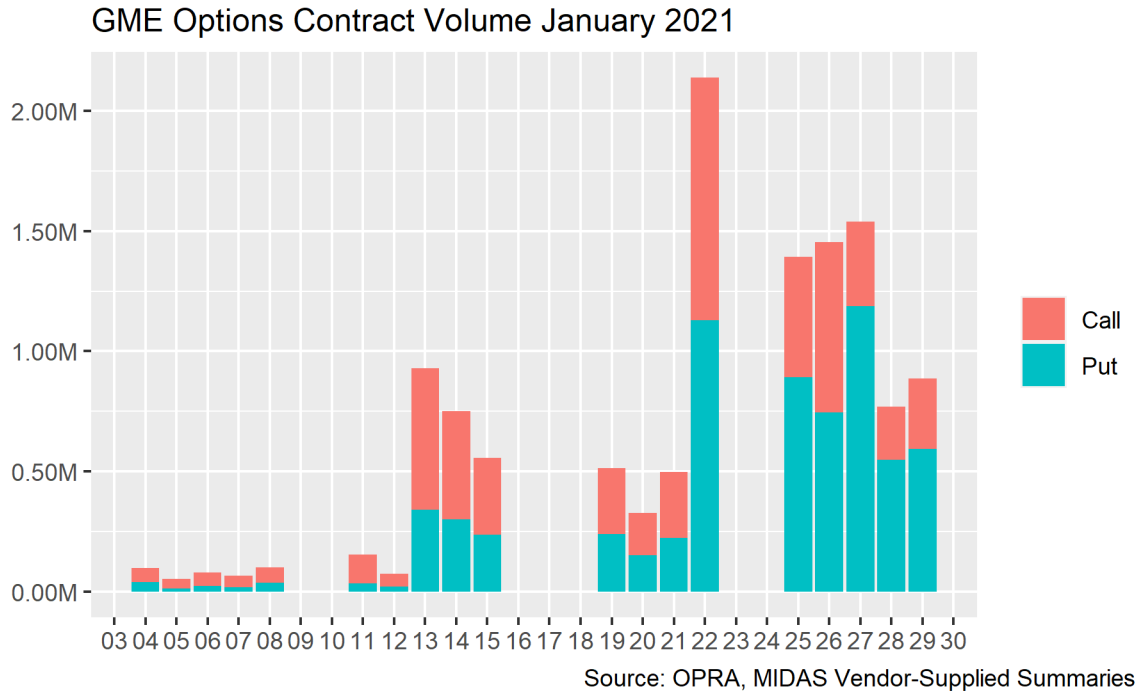


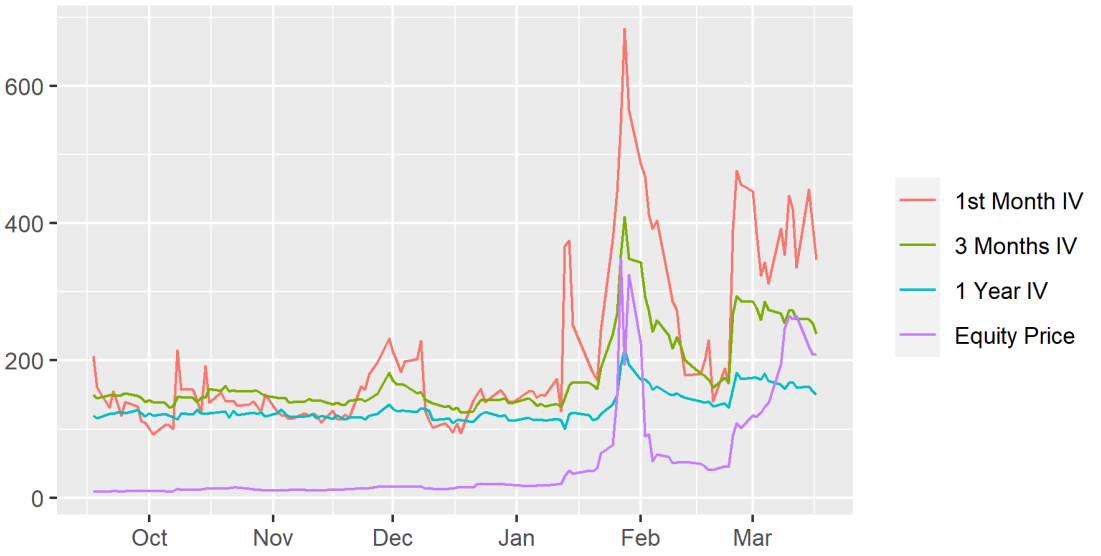
Figure 12



Based on dollar volumes, the increased trading concentrated heavily in call options, a large percentage of which were short-dated.[117] Implied volatility rose dramatically.[118] For example, as shown in Figure 13, below, measures of implied volatility for 50 delta[119] GME contracts reached levels nine times higher than the typical 2020 range.

Figure 13

Implied Volatility for Select GME 50 Delta Contracts
Compared with Equity Closing Price



Source: Bloomberg

117 Theoretically, a large number of call options written could have contributed to further increases in the price of GME. If market makers purchased GME stock to hedge the risk associated with writing call options on GME, it would put further upward pressure on GME's stock price. However, as discussed above, staff did not find evidence of a gamma squeeze for GME during January 2021 in the available data. See supra Section 3.4.

118 The volatility of the underlying is an input into the price of the option; the greater this volatility the greater the price. Implied volatility is the value of the volatility that makes the market-set option price correct, assuming a lognormal distribution. If the distribution is heavy-tailed rather than lognormal, the implied volatility will lie above true volatility; implied volatility may also lie above measured standard deviation in any given sample. Higher implied volatility can therefore indicate (1) higher actual volatility, (2) heavier tails, or (3) market expectations of volatility that are higher than measured.

119 "Delta" refers to the expected relationship between the option price and the underlying stock price. A delta of 50 (sometimes expressed as .50) signals expectations that the options premium would change by .50 for a $1 move in the stock price. A 50 delta option is at-the-money.

Individual customer accounts made up a high percentage of options trading in GME during this time. A small number of retail brokers facilitated this activity, with three brokers (Robinhood, TD Ameritrade, and E*Trade Securities) representing over 66% of individual customer accounts trading GME options.[120] A small number of retail-focused online brokerages had the majority of volume from individual customer accounts, with Robinhood and TD Ameritrade alone accounting for over half of this volume.[121] In mid-January, individual customer accounts reached a peak of 91% of the non-market maker volume in options.[122] By late January, individual customer accounts were associated with only 56% of non-market-maker volume.[123] Between January 22 and January 27, GME traders began to suddenly close their call option positions.[124]

4. Conclusions

The extreme volatility in meme stocks in January 2021 tested the capacity and resiliency of our securities markets in a way that few could have anticipated. At the same time, the trading in meme stocks during this time highlighted an important feature of United States securities markets in the 21st century: broad participation. There are many different types of investors, and they buy and sell stocks for many different reasons. However, when share prices change rapidly and brokerage firms suddenly suspend trading, investors may lose money.

Underneath the memes are actual companies, with employees, customers, and plans to invest in the future. Those who bought GameStop became co-owners of a company through a system of mutual trust and participation that sustains our economy. People may disagree about the prospects of GameStop and the other meme stocks, but those disagreements are what should lead to price discovery rather than disruptions. These events present an opportunity to reflect on the market structure and regulatory framework and identify additional areas for potential study and further consideration in the interests of protecting investors, maintaining fair, orderly, and efficient markets, and facilitating capital formation.

These areas include:

1. *Forces that may cause a brokerage to restrict trading.* A number of clearing brokers experienced intraday margin calls from a clearinghouse. In reaction, some broker-dealers decided to restrict trading in a limited number of individual stocks in a way that some investors may not have anticipated. This episode highlights the integral role clearing

120 Source: Consolidated Audit Trail.

121 Id.

122 Id.

123 Id.

124 Id.

plays in risk management for equity trading, but raises questions about the possible effects of acute margin calls on more thinly-capitalized broker-dealers and other means of reducing their risks. One method to mitigate the systemic risk posed by such entities to the clearinghouse and other participants is to shorten the settlement cycle.

2. *Digital engagement practices and payment for order flow.* Consideration should be given to whether game-like features and celebratory animations that are likely intended to create positive feedback from trading lead investors to trade more than they would otherwise. In addition, payment for order flow and the incentives it creates may cause broker-dealers to find novel ways to increase customer trading, including through the use of digital engagement practices.

3. *Trading in dark pools and through wholesalers.* Much of the retail order flow in GME was purchased by wholesalers and executed off exchange. Such trading interest is less visible to the wider market—and payments to broker-dealers may raise questions about the execution quality investors receive. Further, though wholesalers increasingly handle individual investor order flow, they face fewer requirements concerning their operational transparency and resiliency as compared to exchanges or ATSs.

4. *Short selling and market dynamics.* While short selling and calls on social media for short squeezes received a great deal of media attention, the interplay between shorting and price dynamics is more complex than these narratives would suggest. Improved reporting of short sales would allow regulators to better track these dynamics.