



Full length article

Frenzied buyers and sophisticated sellers: How short sellers trade individual investors' most purchased stocks

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ABSTRACT

Prior literature describes individual investors as “dumb money” and finds that they are irrational, frenzied buyers who display herd-like trading behavior. Using a dataset of individuals' transactions, I examine how short sellers, who are considered sophisticated investors, trade during these periods of intense buying by individual investors. I find that, after controlling for institutional ownership, short interest is significantly higher for stocks that are most purchased by individuals, including financial advisers' purchases in their personal trading portfolio. The findings suggest that when short sellers are not constrained, short sellers and individual investors display different outlooks on stocks' future performance.

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1. Introduction

Individual investors are widely believed to be “dumb”, frenzied investors with herd-like tendencies that buy attention-grabbing stocks (Barber et al., 2009; Bondia et al., 2021; Frazzini and Lamont, 2008). Anecdotal examples in the media further push this narrative. For instance, a 2020 CNBC article reports that “Should I buy Tesla stock” became the most searched “Should I” phrase on Google as individuals' frenzied buying drove the sharp increase in Tesla stock purchases.² The stock had a positive six-month momentum of almost 300% and just a few months later, approximately 40,000 individual investors added shares of Tesla to their portfolios within a four-hour window in just one day.³ With the exception of a few studies that show that individual investors are informed and/or skilled traders (Chague et al., 2019; Gamble and Xu, 2017; Wang et al., 2017; Welch, 2022), much

of the previously cited academic literature and media headlines suggests that individuals are unsophisticated investors.

In this study, I examine how sophisticated investors, specifically short sellers, trade during periods of high purchasing by individual investors. Short sellers are considered sophisticated investors given their superior ability to detect events before they are announced to the rest of the market and predict negative returns, possibly because they are able to process public information better than the rest of the market can.⁴ Further, studies suggest that short sellers may even influence major market events and corporate decision-making.⁵ Building on prior literature, henceforth, this study considers individual investors to be unsophisticated and short sellers to be sophisticated.

Given the documented stark contrast in individual investors and short sellers' trading capabilities and sophistication, I investigate whether the monthly short interest ratio (SIR), defined as the number of shares at month's end shorted divided by the total number of shares outstanding, is significantly higher for the top 20% of purchased stocks by individual investors in a given

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² <https://www.cnbc.com/2020/02/05/should-i-buy-tesla-stock-tops-google-search-terms.html>.

³ <https://markets.businessinsider.com/news/stocks/tesla-stock-added-robinhood-day-traders-buy-hours-monday-whipsaw-2020-7-1029393636#>.

⁴ For examples, see Akbas et al. (2017), Berkman and McKenzie (2012), Blau et al. (2015), Boehmer et al. (2010, 2008), Boehmer and Wu (2013), Cassell et al. (2011), Desai et al. (2002), Diether et al. (2009), Engelberg et al. (2012), Henry et al. (2015), Karpoff and Lou (2010), and Ringgenberg (2014).

⁵ For examples, see Autore et al. (2018), Ben-David et al. (2015), Henry and Koski (2010), Khan et al. (2012), Liu and Swanson (2016), and Massa et al. (2015).

month, relative to the other stocks that individuals purchase during the month. Based on the previously cited differences in individual investors and short sellers, I expect that the monthly SIR will be higher for the most purchased stocks by individuals in a given month. Short sellers can capitalize on individual investors' emotional buying with the expectation that the stock price will eventually correct and come down.

Using a proprietary dataset of individual investors' transactions from a United States brokerage firm, I find that the contemporaneous monthly SIR is 6.6% for the lowest quintile of purchased stocks and 4.7% for the highest quintile, and the difference of -1.9% is statistically significant. However, when controlling for institutional ownership, which is a proxy for short selling constraints, I find that short interest is *higher* during the months of intense buying by individuals, meaning that, when short sellers are not constrained, individual investors and short sellers display different outlooks on stocks' future performance. Further, the same holds true for the stocks that are most purchased by financial advisers. SIR is higher for the most purchased stocks by financial advisers, although less intense when compared to those of individual investors.

Further, when examining individual investors' most purchased stocks that were executed following a financial adviser's recommendation, it appears that the relationship disappears. Thus, it may be possible that financial advisers' professional advice is aligned with the sophisticated traders' outlook even if financial advisers do not subscribe to their own advice in their personal trading practices. However, while univariate results shows that the mean SIR for the top recommended purchases is less than the mean SIR for individuals' and advisers' top purchases, later robustness tests indicate that there is not enough evidence to establish whether short sellers' outlooks are aligned with financial advisers' recommendations. Overall, the results of this study do support that after controlling for institutional ownership, short interest is significantly higher for stocks that are most purchased by individuals, including financial advisers' purchases in their personal trading portfolios.

This study differs from the prior literature in a few ways. While there are studies that examine individual investors' short sales (Chague et al., 2019; Chien et al., 2016; Gamble and Xu, 2017; Hasso et al., 2020; Jung et al., 2013; Kelley and Tetlock, 2017; Tsai et al., 2021; Wang et al., 2017), none analyze how short sellers trade during periods of intense buying by individual investors. One unique feature of this study is that the dataset also includes the personal transactions of financial advisers, who should be relatively more sophisticated than their clients. Indeed, individual investors seek expertise from financial advisers. Additionally, the dataset distinguishes whether the trade was independently initiated by the investor or whether the financial adviser recommended the trade. This examination is worthwhile because financial advice, among other factors, influences an investor's tendency to buy attention-grabbing stocks (Reiter-Gavish et al., 2021a,b).

A limitation of this study is that the results do not disentangle causality channels of individuals' intense buying and short sellers' trading; they establish only the correlation between short sellers and individual investors. Further, the sample used in this study might not be representative of the universe of individual investors.

To my knowledge, this study is the first to examine short selling activity for stocks that are intensely purchased by individual investors. The analysis bridges two strands of literature on sophisticated and non-sophisticated investors, providing a side-by-side comparison of the trading activity for these two distinct groups, and offers new insights on their outlooks. For the individual investor, these findings may shed light on whether it is still

worthwhile to engage a financial professional and to gain a better understanding of how sophisticated investors trade during periods of emotional, frenzied trading that individuals are inclined to. In addition, there may be potential regulatory implications, such as creating additional safeguards for individuals, if there are more opportunities for sophisticated investors to exploit the naivete of less sophisticated investors.

The remainder of the paper is organized as follows. Section 2 describes the data and methodology, Section 3 presents the results, and Section 4 concludes.

2. Data and methodology

The sample is comprised of individual investor stock trades from March 2008–August 2011 in 25,131 accounts obtained from a United States full-service brokerage firm. The study spans this particular period due to the availability of the individual investor data. While the unique dataset offers many advantages, a significant limitation of this study is the dated and limited sample period of 2008–2011. This pitfall is common in the individual investor literature as access to individual investor data is scarce and not publicly available. For example, the sample period in Kelley and Tetlock (2017) is 2003–2007.⁶ Although the sample period in this study is relatively dated, news headlines suggest that short selling activity around intensely purchased stocks is still a relevant topic worth exploring. For example, during the Tesla 2020 stock price run-up, TheStreet.com reported that Tesla's short interest was at an all-time low.^{7,8}

Each account is assigned to a financial adviser: either the client selects a financial adviser, or the brokerage firm assigns a financial adviser to the client. There are 65 advisers in the sample, geographically dispersed throughout all 50 states. While each individual investor has a dedicated financial adviser, all trades are not recommended by an adviser. Each time a trade is executed, the financial adviser must disclose whether or not they recommended the trade. A non-recommended trade means the client independently initiated the trade. The variable, *Recommended*, is a binary variable equal to one if the trade was initially recommended by the financial adviser, and zero if the client independently initiated the trade. Nearly 29% of the trades are recommended by an adviser.

The data also include self-reported characteristics for all investors including location, income, net worth, risk tolerance, and investment objective.⁹ Table 1 reports that 23.39% of the investors report their risk tolerance as high, 74.82% as medium, and 1.75% as low. Only a small percentage invest for capital preservation or speculation (1.17%). Nearly 90% (88.2%) of the

⁶ The use of different datasets in the individual investor literature also leads to mixed results as studies use different datasets from different time periods, countries, investor profiles, and brokerage types. However, these different datasets have allowed researchers to investigate different phenomena that contribute to the literature. For example, the literature has identified various factors that influence investor trading such as air quality, terror attacks, access to broadband internet, macroeconomic news and concerns, behavioral biases, and investment-related postings on social trading platforms (Aharon and Qadan, 2020; Ammann and Schaub, 2021; Farrell et al., 2022; Hasso et al., 2020; Hvide et al., 2022; Kostopoulos et al., 2020; Meyer and Pagel, 2017; Talwar et al., 2021; Wang et al., 2023).

⁷ <https://www.thestreet.com/tesla/articles/tesla-short-interest-declines-as-stock-hits-all-time-high>.

⁸ This finding contradicts the premise of this study, which expects that short interest is higher during periods of frenzied buying as sophisticated and non-sophisticated traders should have different outlooks. Short sellers can capitalize on individual investors' emotional buying with the expectation that the stock price will eventually correct and come down, as supported by this study which shows that when controlling for institutional ownership, which significantly impacts short selling.

⁹ An artificial account identifier to de-identifies the subjects.

Table 1
Investor characteristics.

Panel A: Investor investment preferences					
Risk tolerance		Investment objective		Time horizon	
Low	1.75%	Capital Pres	0.57%	<5 years	14.36%
Medium	74.82%	Growth	88.19%	5–10 years	14.36%
High	23.39%	Income	10.60%	>0 years	81.86%
Panel B: Investor financial profiles					
	Annual income		Net worth		
0–19,999:	7.27%		3.11%		
20,000–50,000:	22.30%		3.55%		
50,001–100,000:	34.76%		7.54%		
100,001–200,000:	22.30%		18.30%		
200,001–500,000:	7.87%		22.67%		
500,001–1,000,000:	1.60%		21.83%		
Over 1,000,000:	0.76%		22.90%		

This table presents the descriptive statistics of the sample of 25,131 investors. All data is self-reported by the investor from a questionnaire that is required to be completed upon opening an account at the brokerage firm. Panel A reports the risk tolerance, primary investment objective, and investment time horizon. Panel B reports the annual income and net worth of all clients.

investors report their primary investment objective as growth, while 10.6% report income. A majority of the investors (57.06%) have an annual income of \$50,000–\$200,000. Almost one-third (29.6%) have an annual income below \$50,000, and 10.2% have an annual income above \$200,000. 14.2% of the investors have a net worth of \$100,000 or less. Nearly one-fifth (18.3%) of the investors have a net worth of \$100,001–\$200,000, 22.7% have \$200,001–\$500,000, 21.8% have \$500,001–\$1,000,000, and 22.9% have over \$1,000,000.^{10, 11}

While the limited sample period is a drawback of the dataset, an important advantage is that it also includes financial advisers' stock transactions in their personal trading portfolio. The brokerage firm requires that advisers execute all of their trades within the brokerage firm only. Thus, the data allow us to examine how short sellers trade stocks that are most purchased by individuals and financial advisers, and whether there are differences in short sellers' activity if the purchases were independently initiated by the individual or recommended by the financial adviser.

Following previous literature, the SIR is computed as the end-of-month number of shares shorted divided by the total number of shares outstanding (Autore et al., 2018; Henry et al., 2015; Karpoff and Lou, 2010; Tsai et al., 2021).¹² To capture the most purchased stocks in the sample, I sort the firms each month into quintiles based on the number of shares that were purchased during the month. This study examines the contemporaneous monthly SIR across quintiles of the most purchased to the least purchased stocks.

For each transaction, the individual investor dataset provides the date of the transaction, stock ticker, transaction type, stock price, number of shares traded, and commissions. I use additional sources for market and accounting data. Stock data is from the Center for Research on Security Prices (CRSP), accounting and short selling data is from Compustat, and institutional ownership data is from Thomson Reuters 13F institutional holdings database. I restrict the sample to stocks that are on CRSP and Compustat. If the difference in the reported stock price and CRSP stock price is

¹⁰ It is unknown how the sample of individual investors in this study compares the prior literature as many of those studies, such as Barber and Odean (2008) and Kelley and Tetlock (2017), do not provide demographic data.

¹¹ An advantage of Reiter-Gavish et al. (2021b) is that they are able to distinguish whether demographic characteristics influence an investors' propensity to follow financial advice using a larger sample of individual investor transactions.

¹² Short interest is stock data (rather than flow data) providing a snapshot of the total number of outstanding short positions each month.

Table 2
Top 20 stocks purchased.

Company	# of Purchases	% of Total Purchases
Citigroup	576,090	3.77%
Insmed	507,133	3.32%
Bank of America	423,447	2.77%
Sirius XM Radio	312,200	2.04%
BPZ Resources	254,844	1.67%
General Electric	212,347	1.39%
Hecla Mining	204,950	1.34%
Citizens Republic Bancorp	194,920	1.27%
Frontier Communications	181,327	1.19%
Huntington Bancshares	180,153	1.18%
Ford Motor	177,022	1.16%
New York Community Bancorp	138,337	0.90%
Western Refining	133,200	0.87%
Intel	129,779	0.85%
Aeterna Zentaris	121,500	0.79%
Genworth Financial	101,666	0.66%
Pfizer	96,329	0.63%
Activision Blizzard	93,623	0.61%
Exxon Mobil	90,517	0.59%
Rite Aid	89,813	0.59%

This table lists the 20 most purchased stocks in the sample from March 2008–August 2011. # of Purchases is the total number of shares that were purchased. % of Total Purchases is the percentage of shares purchased that this represents for the entire sample, which contains 15,290,714 shares purchased.

greater than 20%, I remove the observation from the sample as it may be an erroneous entry. The sample is thus left with 292,305 transactions.

As stated earlier, the study focuses on how short sellers trade the stocks that individual investors most actively purchase. To get an idea of the most purchased stocks out of the 15,290,714 total shares purchased in the sample, I list the top 20 purchased stocks based on the number of shares purchased in Table 2. Many of the companies listed are household names such as Citigroup, Bank of America, General Electric, Ford, Sirius XM, Exxon Mobil, and Rite Aid. The list represents a range of industries, including financial, healthcare, energy, technology, automotive, and consumer staples.

3. Results

Table 3 presents the summary statistics of the stocks in the sample. Panel A presents the summary statistics for all the stocks purchased by individuals in the sample. The SIR is calculated as the end-of-month number of shares short divided by the total number of shares outstanding. In the sample, 80.29% of the stocks have short selling activity. The average SIR of purchased stocks is 5.4%.¹³ Individual investors tend to purchase larger value firms. Consistent with previous literature, investors tend to purchase firms that had a recent positive momentum within the prior six months (Jegadeesh and Titman, 1993). On average, institutions own 75.4% of the shares in the sample. Institutional ownership is an important factor to consider because it is a proxy for the availability of shares that can be shorted (Nagel, 2005). Lower institutional ownership represents more short selling constraints.

To examine short selling activity for the most purchased stocks in the sample, I sort the firms into quintiles each month based on the number of shares that have been purchased by individuals. In Panel B, I report the average SIR for each quintile. I observe a monotonically decreasing relationship between the individual investors' purchases and SIR. The least purchased stocks have an average SIR of 6.6%, and the most purchased stocks have an

¹³ This is relatively higher than the SIR that other studies report when examining different samples. For example, Autore, Hutton, Jiang, and Outlaw (2018) and Ben-David et al. (2015) report an average SIR of 2.5%.

Table 3
Stock characteristics for purchases.

Panel A: All purchases					
Variable	N	Mean	Std Dev	Min	Max
SIR	18,476	0.054	0.143	0.000	6.602
Size	23,012	15.261	1.749	7.467	20.023
Momentum	22,693	0.081	0.470	-0.956	26.500
B/M	18,501	1.994	11.910	0.000	667.757
InstitOwnership	11,790	0.754	0.268	0.000	1.751
Panel B: All purchases and SIR					
	SIR				
Lowest purchased	0.066				
2nd quintile	0.053				
3rd quintile	0.054				
4th quintile	0.049				
Highest purchased	0.047				
High-Low	-0.019*** (4.87)				
Panel C: Financial adviser purchases					
Variable	N	Mean	Std Dev	Min	Max
SIR	2,784	0.064	0.217	0.000	4.391
Size	3,509	15.396	1.966	8.384	19.966
Momentum	3,459	0.085	0.425	-0.926	10.263
B/M	2,788	1.875	15.149	0.000	667.757
InstitOwnership	1,806	0.729	0.261	0.000	1.347
Panel D: Financial adviser purchases and SIR					
	SIR				
Lowest purchased	0.080				
2nd quintile	0.069				
3rd quintile	0.059				
4th quintile	0.059				
Highest purchased	0.056				
High-Low	-0.024 (1.37)				

This table presents the stock summary statistics of purchases in the sample from March 2008–August 2011. SIR is the short interest ratio computed as the number of shares shorted divided by the number of shares outstanding. Size is the natural log of the market capitalization of the stock. Market capitalization is the number of shares outstanding multiplied by the price per share. B/M is the ratio of book assets divided by market value at the end of the fiscal year ending as of December of the prior year. This variable remains the same from July of year t through June of year $t - 1$. Momentum is the cumulative stock return over the prior six months. InstitOwnership is the number of shares held by institutions divided by the number of shares outstanding. Panel A and B reports the summary statistics for all purchases and financial advisers' purchases, respectively. Panel C reports the mean SIR by quintile for all purchases. Panel D reports the mean SIR by quintile for financial advisers' purchases. Firms are sorted into quintiles each month based on the number of shares purchased. High-Low is the mean difference in SIR between the highest and lowest purchase groups. Newey and West (1987) t -statistics are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

average SIR of 4.7%. The difference in SIR between the highest and lowest quintiles (-1.9%) is statistically significant at the 1% level. This univariate result suggests that short interest is lowest for the most purchased stocks (which is consistent with TheStreet's anecdotal evidence that short interest is lowest while Tesla's stock price hit an all-time high, but inconsistent with my initial hypothesis).

Panel C reports the summary statistics of the stocks purchased by financial advisers in their personal portfolios. The characteristics of stocks purchased by financial advisers is qualitatively similar to those purchased by individual investors. The mean SIR is 6.4%. It appears that financial advisers also prefer to purchase larger value firms, with positive momentum. On average, institutions own 72.9% of the shares in the financial adviser subsample.

In Panel D, I recreate the sorts but for the stocks purchased by financial advisers. I find that the decreasing SIR trend across

quintiles for financial advisers' purchases (Panel D) is similar for all purchases (Panel B), but the difference between the highest and lowest quintiles is statistically insignificant, which suggests that there is no difference in SIR for the most or least purchased stocks by financial advisers. However, Table 4 shows that, when controlling for short selling constraints in multivariate regressions, SIR is higher for the most purchased stocks by individual investors as well as by financial advisers.

Next, I run multivariate regressions to control for additional factors that impact trading and short selling. I sort the firms into monthly quintiles based on the number of shares purchased during the month. *Top20%Purch* equals 1 for stocks that are in the top quintile of purchases for the month, and all others are assigned 0. I regress *Top20%Purch* against SIR and other known determinants of trading and short selling to determine whether SIR is significantly higher or lower for the most purchased stocks. Because some noteworthy events occurred during the sample period such as the 2008 financial crisis and new short selling restrictions,¹⁴ I also control for monthly time fixed effects and industry fixed effects to alleviate the concern of atypical circumstances impacting the results.

Table 4 presents the regression results. Consistent with the univariate results, model (1) shows that, when SIR is the only variable in the regression, SIR is negative and significant. The same is true when controlling for size, B/M, and momentum in model (2). When institutional ownership is controlled for in model (3), the coefficient on SIR becomes positive (0.836) and significant. Institutional ownership is an important determinant for short selling because it is a proxy for the supply of lendable shares (Nagel, 2005). Less institutional ownership places short selling constraints on short sellers because, although short sellers may want to open positions in a particular stock, it is not available to be shorted. This result suggests that when trading constraints are not in the way, short sellers actually have higher positions in the stocks most purchased by investors.¹⁵

As previously stated, due to data limitations, there is limited research on how professionals trade compared to individual investors. One unique advantage of the individual investor dataset used in this study is that I can examine how financial advisers trade in their personal portfolios. As individuals seek financial advice for their knowledge and expertise, it would be interesting to see if short sellers are also pessimistic about advisers' most purchased stocks. Specifically, I examine financial advisers' personal purchases to determine whether their top purchases are in line with the more sophisticated investors, similarly to the purchases they recommend to their clients.

I recreate quintiles for the subsample of financial advisers' personal purchases; *Top20%Purch* equals 1 for stocks that are in the top quintile of financial advisers' purchases for the month, and all others are assigned 0. I rerun the multivariate regressions for this subsample and report the results in Panel B. The regression results are consistent, albeit slightly weaker, with the individuals' purchases in Panel A. For financial advisers' personal purchases, SIR is positive and marginally significant when controlling for other factors. This finding suggests that short sellers' perception of the stocks most purchased by financial advisers – who individuals seek for their expertise – is similar, albeit weaker, to that of “dumb money” individual investors.

¹⁴ See SEC announcement <https://www.sec.gov/news/press/2008/2008-211.htm>.

¹⁵ Consistent with prior literature, D'Avolio (2002) finds that relative to all other stock characteristics, institutional ownership seems to be the best proxy for the severity of short sale constraints.

Table 4
Short interest around stock purchases.

Panel A: All purchases			
	Dependent variable: Top 20% purchased		
	(1)	(2)	(3)
SIR	−0.495*** (−4.87)	−0.595*** (−5.05)	0.836** (2.51)
Size		−0.048*** (−6.00)	−0.022* (−1.73)
Momentum		−0.075 (−1.63)	−0.096* (−1.77)
B/M		−0.006* (−1.79)	0.082** (2.57)
InstitOwnership			−0.755*** (−12.44)
Time fixed-effects	Yes	Yes	Yes
Industry fixed-effects	Yes	Yes	Yes
Firm clustering	Yes	Yes	Yes
Pseudo R ²	8.15%	8.83%	8.14%
Obs	18,476	18,237	9,394
Panel B: Financial advisers' purchases in their personal portfolios			
	Dependent variable: Top 20% purchased		
	(1)	(2)	(3)
SIR	−0.051 (−0.56)	−0.255* (−1.95)	1.760* (1.75)
Size		−0.105*** (−5.67)	−0.082*** (−2.76)
Momentum		0.069 (0.93)	0.090 (1.11)
B/M		−0.022*** (−2.77)	0.188* (1.89)
InstitOwnership			−0.941*** (−5.20)
Time fixed-effects	Yes	Yes	Yes
Industry fixed-effects	Yes	Yes	Yes
Firm clustering	Yes	Yes	Yes
Pseudo R ²	11.99%	14.53%	18.48%
Obs	2,784	2,755	1,411

This table reports results from panel probit regressions that predict the likelihood of being one of the most purchased stocks. The dependent variable is a binary variable, *Top20%Purch*, which equals one if the firm is in the top quintile of stock purchases by individual investors for month (*m*). The key independent variable is SIR, the short interest ratio measured at the end of month *m*. SIR is the short interest ratio computed as the number of shares shorted divided by the number of shares outstanding. Size is the natural log of the market capitalization of the stock. Market capitalization is the number of shares outstanding multiplied by the price per share. B/M is the ratio of book assets divided by market value at the end of the fiscal year ending as of December of the prior year. This variable remains the same from July of year *t* through June of year *t* − 1. Momentum is the cumulative stock return over the prior six months. *InstitOwnership* is the number of shares held by institutions divided by the number of shares outstanding. Panel B reports the results for the subsample of financial advisers' purchases in their personal trading portfolios. I control for time (month) and industry fixed effects in all regressions. Reported in the parentheses are the χ^2 -statistics based on standard errors adjusted for clustering at the firm level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

3.1. Recommended purchases

Table 5 presents the summary statistics for the subsample of purchases that were recommended by a financial adviser. Ultimately the investor approves the trade, but the financial adviser initially recommends the trade. While firm size is similar to the characteristics of all purchases, there are a few distinctions for the recommended purchases (see Table 3). Interestingly, stock momentum is lower for the recommended stocks, suggesting that financial advisers' recommendations are less based on past performance. Rather, advisers seem to recommend growth stocks, which is consistent with the majority of individuals reporting growth as their primary investment objective. In addition, SIR is relatively lower for recommended purchases (4.1%).

Table 5
Stock characteristics for recommended purchases.

Panel A: Recommended purchases					
Variable	N	Mean	Std Dev	Min	Max
SIR	4,204	0.041	0.078	0.000	1.609
Size	4,963	15.447	2.080	7.467	19.966
Momentum	4,893	0.055	0.410	−0.933	10.263
B/M	4,205	0.653	2.008	0.000	48.523
InstitOwnership	2,102	0.681	0.263	0.000	1.460
Panel B: Recommended purchase and SIR					
					SIR
Lowest purchased					0.042
2nd quintile					0.045
3rd quintile					0.044
4th quintile					0.039
Highest purchased					0.036
High–Low					−0.006* (1.72)

This table presents the stock summary statistics for stock purchases that were recommended by a financial adviser in the sample from March 2008–August 2011. SIR is the short interest ratio computed as the number of shares shorted divided by the number of shares outstanding. Size is the natural log of the market capitalization of the stock. Market capitalization is the number of shares outstanding multiplied by the price per share. B/M is the ratio of book assets divided by market value at the end of the fiscal year ending as of December of the prior year. This variable remains the same from July of year *t* through June of year *t* − 1. Momentum is the cumulative stock return over the prior six months. *InstitOwnership* is the number of shares held by institutions divided by the number of shares outstanding. Panel A reports the summary statistics for purchases that were recommended by a financial adviser. Panel B reports the mean SIR for stock purchases that were recommended by a financial adviser. Firms are sorted into quintiles each month based on the number of shares purchased. High–Low is the mean difference in SIR between the highest and lowest purchase groups. Newey and West (1987) *t*-statistics are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

If financial advisers are more sophisticated than their clients and provide valuable advice, I expect to see either no difference in SIR or a less pronounced difference in SIR for the top purchases that are recommended by financial advisers. In Panel B, I recreate the stock purchase quintiles for the subsample of purchases that were recommended by a financial adviser. While there is still a decreasing SIR relationship, it is less pronounced for the recommended subsample relative to all purchases in Table 3. The difference in SIR between the highest and lowest quintiles (−0.6%) is marginally significant, which suggests that the SIR and purchase relationship is less pronounced for purchases that are recommended by a professional. A potential explanation is that financial advisers' suggestions cause less frenzied, emotional trading by individuals; therefore, these purchases may be more rational and may align with short sellers' views.

In Table 6, I rerun the regressions for the subsample of purchases that were recommended by financial advisers. *Top20%Purch* equals 1 for stocks that are in the top quintile of recommended purchases for the month, and all other recommended stocks are assigned 0. Models (1) and (2) are consistent with the initial finding that SIR is lower for the most purchased stocks. However, when controlling for institutional ownership in model (3), SIR becomes insignificant, which could suggest that short sellers do not have significantly higher or lower positions in the stocks that are recommended by financial advisers.

As short sellers are considered to be more sophisticated than individual investors and financial advisers offer professional advice to their clients, it is plausible that advisers' outlooks and professional recommendations are more in line with the opinions of sophisticated traders. Financial advisers' most recommended purchases may be less herd-like and frenzied than individuals' independently initiated purchases. This finding may shed light

Table 6
Short interest and recommended purchases.

	Dependent variable: Top 20% purchased		
	(1)	(2)	(3)
SIR	-0.737** (-2.16)	-1.114** (-2.48)	0.912 (0.90)
Size		-0.175*** (-12.30)	-0.129*** (-4.16)
Momentum		-0.040 (-0.64)	-0.051 (-0.53)
B/M		-0.037** (-2.29)	0.243*** (2.61)
InstitOwnership			-0.505*** (-2.92)
Time fixed-effects	Yes	Yes	Yes
Industry fixed-effects	Yes	Yes	Yes
Firm clustering	Yes	Yes	Yes
Pseudo R ²	9.19%	15.18%	22.84%
Obs	4,204	4,151	1,712

This table reports results from panel probit regressions that predict the likelihood of being one of the most purchased stocks that was recommended by a financial adviser. The dependent variable is a binary variable, Top20%Purch, which equals one if the firm is in the top quintile of stock purchases by individual investors that are in the subsample of trades recommended by the financial adviser for month m . The key independent variable is SIR, the short interest ratio measured at the end of month m . SIR is the short interest ratio computed as the number of shares shorted divided by the number of shares outstanding. Size is the natural log of the market capitalization of the stock. Market capitalization is the number of shares outstanding multiplied by the price per share. B/M is the ratio of book assets divided by market value at the end of the fiscal year ending as of December of the prior year. This variable remains the same from July of year t through June of year $t - 1$. Momentum is the cumulative stock return over the prior six months. InstitOwnership is the number of shares held by institutions divided by the number of shares outstanding. I control for time (month) and industry fixed effects in all regressions. Reported in the parentheses are the χ^2 -statistics based on standard errors adjusted for clustering at the firm level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

on whether more individual investors should seek professional trading advice as some prior studies suggest financial advisers are honest and helpful to their clients (Bluethgen et al., 2008; Kramer, 2012). This result would also align with the findings of Reiter-Gavish et al. (2022) who show that investors receiving financial advice during the 2008 financial crisis were less likely to trade emotionally, panic, and leave the stock market. Furthermore, the presence of financial advisers in the sample as both professional experts and individual investors further contributes to the literature to determine whether financial advisers' trades are aligned with their advice, whether the financial advice is value-adding for individuals, and whether the advice better aligns individuals' outlooks with that of sophisticated traders (Bhattacharya et al., 2012; Bodnaruk and Simonov, 2015; Kaustia et al., 2008; Linnainmaa et al., 2021; Locke and Mann, 2005; Outlaw and Outlaw, 2016; Shapira and Venezia, 2001). Perhaps financial advisers do not follow their own advice in their personal trades. While this may seem counterintuitive, it may be the case of doctors who encourage patients to adopt healthy lifestyle habits yet smoke themselves (Garfinkel and Stellman, 1986).¹⁶

3.2. Robustness

While the SIR multivariate results yield interesting conclusions about the differences between short selling activity for

¹⁶ The World Health Organization, among other survey sources, finds that several decades later, 27.83% of physicians self-report that they currently smoke, and it is most prevalent among those training to be surgeons. For more information, please see <https://www.hcplive.com/view/shocking-percent-of-physicians-still-smoking>.

the most purchased stocks that were recommended, one glaring concern is that the results may be driven by the different sample sizes. Specifically, when comparing the multivariate results of all purchases (Table 4) and recommended purchases (Table 6), the SIR coefficients in models (3) are similar (0.836 and 0.912), but the coefficient is statistically insignificant for the recommended subsample. Larger standard errors in this smaller subsample might explain the difference in results. I attempt to alleviate this concern using univariate and multivariate analyses.

First, I compare the mean SIR of the two samples using a Welch's two-sample t-test to determine whether the mean SIR of the two samples is statistically different from one another. As Welch's t-test controls for unequal variances and sample sizes, the results should give some insight into whether there is a statistical difference among the two samples worth exploring (Austin, 1992). The mean SIR of all purchases is 5.4% (Table 3) and the mean SIR of recommended purchases is 4.1% (Table 5). The Welch's t-test statistic indicates that the difference in SIR (1.3%) yields a t-statistic of 7.84, significant at the 1% level.

Second, I attempt to alleviate the different sample size issue by repeatedly creating random subsamples of all purchases that contain 1,712 observations. For comparison purposes, I select 1,712 observations because that is how many observations are in the recommended subsample specification (Table 6, Model 3). I rerun the regression for each subsample and report the average coefficient and t-statistic along with the percentage number of how many of the random samples yield significant results. If the results are not driven by the different sample sizes, the SIR coefficient should be significant a majority of the time. When I rerun the regression, which includes size, B/M, momentum, and institutional ownership for 250 random samples, SIR has an average coefficient of 1.397 and average t-statistic of 1.95. The SIR coefficient is significant 76%, 54%, and 24% of the time at the 10%, 5%, and 1% level, respectively.¹⁷ The results are marginally significant more than three-fourths of the time, and they are significant at the 5% level only a little more than half the time. Thus, although the mean SIR for the top recommended purchases is less than the mean SIR of all (and financial advisers') top purchases, the significantly smaller sample size of the recommended subsample makes the multivariate regression result unreliable. Therefore, the study cannot determine whether the SIR relationship disappears for the most purchased stocks that were recommended.

3.3. Returns

Finally, although the literature considers individuals to be emotional, frenzied traders, it is possible that their most purchased stocks are actually good purchase decisions if the stocks yield positive returns. In that case, even if sophisticated short sellers have higher positions in those stocks, individuals are making an optimal, rational purchase decision. Hence, I also examine the stock returns of the recommended vs. independently initiated trades to determine how the top-purchased stocks perform.

In Table 7, I report the cumulative abnormal returns (CARs) following the purchases for the subsample of the top 20% independently initiated purchases and the subsample of the top 20% recommended purchases. I report the average one-month

¹⁷ I also rerun the regression 100 and 500 times for randomly created samples of 1712 observations, and the results are qualitatively similar. For 100 random samples, the SIR coefficient is significant 85%, 60%, and 35% of the time at the 10%, 5%, and 1% level, respectively. For 500 random samples, the SIR coefficient is significant 76%, 52%, and 17% of the time at the 10%, 5%, and 1% level, respectively. Further institutional ownership is negative and significant at the 1% level 100% of the time, further supporting D'Avolio (2002) that relative to all other stock characteristics, institutional ownership seems to be the best proxy for the severity of short-sale constraints.

Table 7
Returns for Independently initiated vs. Recommended purchases.

	Panel A: Market-adjusted returns		
	CAR (1,20)	CAR (1,126)	CAR (1,252)
Independent	0.009***	0.027***	0.055***
Recommended	0.010***	0.043***	0.058***
Diff	-0.001	-0.016	-0.003
t-stat	(-0.34)	(-1.60)	(-0.21)
	Panel B: Market model		
	CAR (1,20)	CAR (1,126)	CAR (1,252)
Independent	-0.001	-0.029***	-0.064***
Recommended	0.001	-0.018	-0.049***
Diff	-0.002	-0.011	-0.015
t-stat	(-0.55)	(-0.88)	(-0.74)

This table reports the mean cumulative abnormal returns (CARs) computed using market-adjusted returns (Panel A) and the market model (Panel B) following a purchase. CARs are reported for the subsamples of the top 20% of purchases that are independently initiated by individuals (Independent) and those that are recommended by an adviser (Recommended). CAR (1,20), (1,126), and (1,252) represents the cumulative abnormal return for 20, 126, and 252 trading days following the purchase, respectively. *t*-statistics of the differences are reported in the parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

(1,20), six-month (1,126), and one-year (1, 252) CARs using the market-adjusted model and the market model. I compare the differences in CARs for the independently initiated purchases and the recommended purchases to determine whether there is also a significant difference in stock performance.

Using the market-adjusted returns in Panel A, I find that both the independent and recommended top 20% purchases have significantly positive returns for one month, six months, and one year following the purchase. The recommended purchases have slightly higher returns, albeit insignificantly different from the independent purchases over one month, six months, and one year.

Using the market model in Panel B, I find that the one-month CARs are statistically insignificant for the top quintile of purchases for both subsamples. For the six-month CARs, the most independently initiated purchases underperform the market (-2.9%), which may explain why short sellers target these stocks. The six-month CARs for the recommended purchases are statistically insignificant from zero, and the difference in six-month CARs between the independent versus recommended subsamples is insignificant. The one-year CARs are negative and significant for both groups suggesting that these stocks underperform the market. Again, the difference in returns is insignificant.

Overall, I find that there is no significant difference in stock performance for the independent vs. recommended top purchases. Although SIR is higher for the most independently initiated purchases, these purchases do not significantly underperform the top recommended purchases. Thus, the return performance of the most purchased stocks that are independently initiated versus recommended is inconclusive. Based on the inconclusive stock performance results, the results of this study cannot claim whether financial advisers help their clients make better stock purchase decisions.

In summary, the findings of this study establish a correlation between high short selling around the most purchased stocks by individuals, including financial advisers whom individuals engage for their financial knowledge and sophistication. As previously mentioned, a limitation of the study is that this relationship is not an indication of causality because it is possible that other forces are driving the stock price changes which motivate individual investors and short sellers to trade. While the scope of this study focuses on short sellers' contrarian positions in relation to individual investors' optimism, future research may extend

the documented correlation in this article to explore causality channels of intense buying by individuals and higher trading by short sellers.

4. Conclusion

As more individual investors invest in the stock market and trade independently due to increased accessibility through on-line brokerages such as Robinhood (Welch, 2022), understanding short sellers' activity relative to individual investors' trading is important because it provides a glimpse of how sophisticated short sellers trade during times of intense, frenzied buying by individual investors. The univariate analyses show that short interest is lower during periods of intense buying by individuals. However, when controlling for factors that impact short selling, particularly institutional ownership, short interest is significantly higher for the top 20% of purchased stocks by individuals. Further, the same is true for the most purchased stocks by financial advisers in their personal portfolios. This finding suggests that, despite financial advisers' expert knowledge and advice, their personal outlook may be more in-line with individual investors than with sophisticated traders.

CRedit authorship contribution statement

Dominique Outlaw: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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