Do Institutional Investors Stabilize Equity Markets in Crisis Periods? Evidence from COVID-19

Finance Working Paper N° 688/2020
April 2021

Simon Glossner
University of Virginia

Pedro Matos
University of Virginia and ECGI

Stefano Ramelli
University of Zurich

Alexander F. Wagner
University of Zurich, Swiss Finance Institute, CEPR and ECGI

ECGI Working Paper Series in Finance

Do Institutional Investors Stabilize Equity Markets in Crisis Periods? Evidence from COVID-19

Working Paper N° 688/2020

April 2021

Simon Glossner
Pedro Matos
Stefano Ramelli
Alexander F. Wagner

Glossner and Matos acknowledge financial support from the Richard A. Mayo Center for Asset Management at the Darden School of Business. Ramelli and Wagner acknowledge financial support from the University of Zurich Research Priority Program "Financial market regulation." We thank Vikas Agarwal, Marie Briére, Jim Naughton, Raman Uppal, Sugata Ray, Arthur Romec, Richard Sias, Johan Sulaeman, Kazuo Yamada, and Richard J. Zeckhauser, and conference participants at the FSU Suntrust Conference, Midwest Finance Association Conference and seminars at Atlanta Fed and UVA Darden School of Business for insightful comments. We declare that we have no relevant or material financial interests that relate to the research described in this paper. A previous version of this paper was entitled "Where do institutional investors seek shelter when disaster strikes? Evidence from COVID-19."

Abstract

During the COVID-19 market crash, U.S. stocks with higher and more active institutional ownership performed worse. The effect was stronger when institutional investors experienced larger client outflows and held more financially exposed portfolios. This relation holds even when controlling for changes in analysts' earnings forecasts, suggesting that stocks held more by institutions exhibited a larger wedge between stock price drops and firm fundamentals. Portfolio changes through the first quarter of 2020 reveal that institutional investors prioritized corporate financial strength over ''soft'' environmental and social performance. Trading data from a large discount brokerage (Robinhood) confirm that retail investors acted as liquidity providers. Overall, the results suggest that when a tail risk realizes, institutional investors amplify price crashes by fire-selling and seeking shelter in ''hard'' measures of firm resilience.

Keywords: Cash holdings, Coronavirus, Corporate debt, COVID-19, ESG, Fire sales, Institutional ownership, Leverage, Pandemic, Retail investors, Robinhood, Tail risk

JEL Classifications: G01, G12, G14, G32, F14

Simon Glossner
Researcher
University of Virginia, Darden School of Business
100 Darden Boulevard
Charlottesville, VA 22903, United States
e-mail: glossners@darden.virginia.edu

Pedro Matos
Professor of Business Administration
University of Virginia, Darden School of Business
100 Darden Boulevard
Charlottesville, VA 22903, United States
phone: +1 434 243 8998
e-mail: MatosP@darden.virginia.edu

Stefano Ramelli
Researcher
University of Zurich, Department of Banking and Finance
Plattenstr. 14
CH - 8032 Zurich, Switzerland
phone: +41 44 634 19 03
e-mail: stefano.ramelli@bf.uzh.ch

Alexander F. Wagner*
Associate Professor of Finance
University of Zurich, Department of Banking and Finance
Plattenstr. 14
8032 Zürich, Switzerland
phone: +41 446 343 963
e-mail: alexander.wagner@bf.uzh.ch

*Corresponding Author

Do institutional investors stabilize equity markets in crisis periods?

Evidence from COVID-19*

Simon Glossner†, Pedro Matos‡, Stefano Ramelli§, and Alexander F. Wagner¶

April 2021

Abstract

During the COVID-19 market crash, U.S. stocks with higher and more active institutional ownership performed worse. The effect was stronger when institutional investors experienced larger client outflows and held more financially exposed portfolios. This relation holds even when controlling for changes in analysts' earnings forecasts, suggesting that stocks held more by institutions exhibited a larger wedge between stock price drops and firm fundamentals. Portfolio changes through the first quarter of 2020 reveal that institutional investors prioritized corporate financial strength over ''soft'' environmental and social performance. Trading data from a large discount brokerage (Robinhood) confirm that retail investors acted as liquidity providers. Overall, the results suggest that when a tail risk realizes, institutional investors amplify price crashes by fire-selling and seeking shelter in ''hard'' measures of firm resilience.

Keywords: Cash holdings, Coronavirus, Corporate debt, COVID-19, ESG, Fire sales, Institutional ownership, Leverage, Pandemic, Retail investors, Robinhood, Tail risk

*Glossner and Matos acknowledge financial support from the Richard A. Mayo Center for Asset Management at the Darden School of Business. Ramelli and Wagner acknowledge financial support from the University of Zurich Research Priority Program ''Financial market regulation.'' We thank Vikas Agarwal, Marie Brière, Jim Naughton, Raman Uppal, Sugata Ray, Arthur Romec, Richard Sias, Johan Sulaeman, Kazuo Yamada, and Richard J. Zeckhauser, and conference participants at the FSU Suntrust Conference, Midwest Finance Association Conference and seminars at Atlanta Fed and UVA Darden School of Business for insightful comments. We declare that we have no relevant or material financial interests that relate to the research described in this paper. A previous version of this paper was entitled ''Where do institutional investors seek shelter when disaster strikes? Evidence from COVID-19.'' Address of Glossner and Matos: UVA Darden, 100 Darden Boulevard, Charlottesville, VA 22903, USA. Address of Ramelli and Wagner: University of Zurich, Department of Banking and Finance, Plattenstrasse 14, CH-8032 Zurich, Switzerland.

†University of Virginia Darden School of Business. Email: GlossnerS@darden.virginia.edu.

‡University of Virginia Darden School of Business, ECGI. Email: MatosP@darden.virginia.edu.

§University of Zurich. Email: stefano.ramelli@bf.uzh.ch.

¶University of Zurich, CEPR, ECGI, Swiss Finance Institute. Email: alexander.wagner@bf.uzh.ch.

1 Introduction

Institutional ownership (IO) plays a crucial role in stock markets and currently accounts for over 75% of U.S. outstanding shares with IO being up from below 40% in 1980. Institutional investors are widely considered to be sophisticated money managers. In normal times, their presence positively contributes to stock market efficiency and corporate value creation.[1] But what is their role during crisis periods? Their professional investment approach could help to stabilize markets.[2] However, Stein (2009) points out that when institutions enter the same trades and deleverage at the same time, they could exacerbate stock market crashes.[3]

In this paper, we use the novel coronavirus (COVID-19) pandemic as an exogenous shock to explore this tension and to study how institutional investors react to a tail risk event. The COVID-19 pandemic is a powerful and exogenous shock given that it was a globally disruptive natural disaster that did not originate from changes in underlying economic conditions. In fact, few firms had ex-ante identified pandemics as a material risk (Loughran and McDonald, 2020). It is, therefore, unlikely that institutional investors were able to preposition themselves by avoiding stocks that would be hit hardest by an upcoming pandemic. This is in contrast to, for example, the Global Financial Crisis (GFC), which arose from frictions in financial markets that developed over time, giving institutional investors some time to reposition their portfolios. This feature presents empirical studies of the role of institutional investors in the

[1]Prior literature has shown that institutional investors increase price efficiency (Boehmer and Kelley, 2009; Bai et al., 2016), facilitate the incorporation of future corporate news into prices (Campbell et al., 2009; Hendershott et al., 2015), and improve corporate governance (e.g., Dasgupta et al., 2020)

[2]For example, Chen et al. (2019) show that around the 9/11 terrorist attacks, institutional investors lent a ''steady hand.''

[3]There is also some evidence of this phenomenon. For example, Dennis and Strickland (2002) find excessive herding by institutional investors on days with large market moves. The deleveraging by hedge funds in particular came under scrutiny in the Global Financial Crisis (Ben-David et al., 2012).

GFC and other financial crisis episodes with difficult identification challenges.

We find that U.S. stocks with higher IO collapsed more in the historic market correction that occurred in the first quarter of 2020. A battery of tests suggests that institutional investors engaged in ''fire sales'' of their equity holdings. While there is no universally accepted definition of what constitutes a fire sale, such a situation typically occurs when a fundamental shock (in this case, COVID-19 exposure) triggers asset sales at a discount. This, in turn, generates a cascade of subsequent sales by other institutions that have similar stock exposures and are forced to de-risk their portfolios, potentially further enhanced by capital withdrawals (Shleifer and Vishny, 2011).

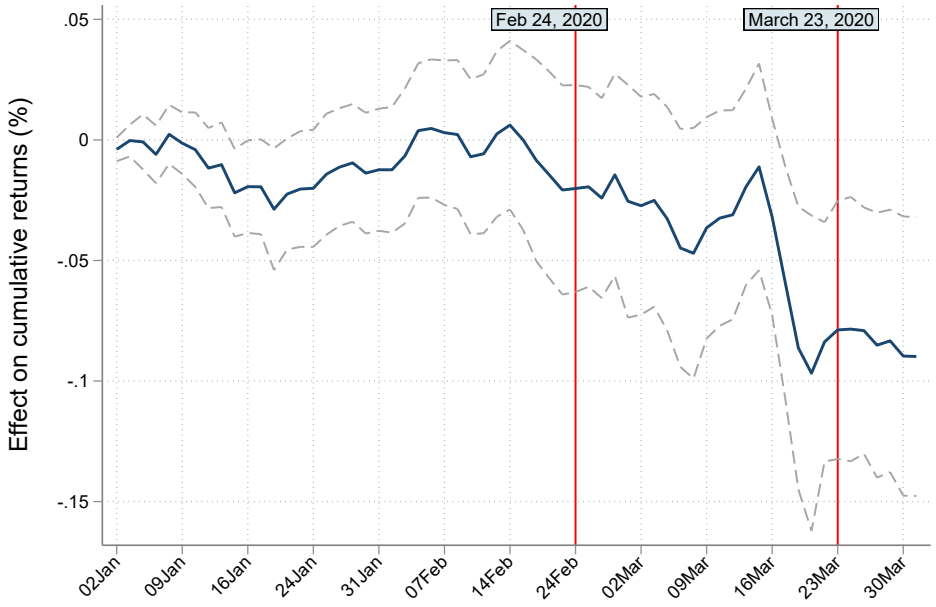
Our starting point of analysis is the result displayed in Figure 1, which shows that for U.S. non-financial Russell 3000 firms the stock price performance during the *Fever* period (Ramelli and Wagner, 2020) -- from February 24 through March 20, 2020[4] -- is negatively related to the firm's end-of-2019 IO ratio, while controlling for many firm and industry characteristics.[5]

To explain this baseline result, our paper poses and answers three questions. First, did institutional investors amplify the COVID-19 stock crash by fire-selling? Second, did institutions sell stocks indiscriminately or did they rebalance their equity portfolios in a ''flight-to-quality''? If the latter, which stocks did they perceive as signaling ''quality'' in this tail risk event? Third, do we observe reversals in institutional investor positioning and stock returns in the second quarter of 2020?

[4]On Sunday February 23, Italy initiated the first major intervention and the World Health Organization characterized COVID-19 as a pandemic on March 11 (`https://ourworldindata.org/coronavirus`).

[5]This result also holds for international stocks. See Online Appendix Figure OA1 for similar patterns observed on MSCI ACWI index stocks.

Figure 1: Stock prices and institutional ownership
This graph shows the evolution of the coefficients on IO_{2019Q4} in regressions with the cumulative returns of Russell 3000 non-financial stocks from January 2, 2020 each day through March 31, 2020 as the dependent variable. IO_{2019Q4} is the percentage of a stock's outstanding shares owned by institutional investors at the end of the fourth quarter of 2019. The regressions control for firm characteristics (Cash/assets, Leverage, Market beta, Stock illiquidity, log(Market cap), Profitability, and Book-to-market) and industry fixed effects. The red vertical lines mark, respectively, the beginning of the *Fever* period (from February 24 through March 20), and the announcement of the Fed interventions (on March 23). The dashed lines indicate 90% confidence intervals based on robust standard errors.



We begin by investigating the relation of IO and returns in the crisis. The overall picture from our tests suggests that fire sales occurred. The first set of results pertain to the ''activeness'' of institutions holding a stock and to the stability of the institutions' client base. We find that the negative relation between IO and *Fever* stock performance is more pronounced for stocks held by more actively managing and more short-term oriented institutional investors. This provides first indicative evidence that active portfolio choices by these managers played a role. Moreover, the behavior by the clients of institutional investors regarding capital withdrawals also contributed to the effect. Stock prices fell more

in stocks held by institutional investors that had higher client outflows in the first quarter of 2020. This suggests that some of the portfolio managers' decisions to sell were due to forced liquidations of holdings.

Second, the composition of institutional investors' portfolios impacted the "fragility" of a stock's investor base. Firms with low cash and high leverage experienced greater declines when these were held by institutional investors with portfolios heavily exposed to *other* firms with weak corporate financials. Prior work has identified low cash and high leverage as indicators of low COVID-19-resilience (Ramelli and Wagner, 2020; Fahlenbrach et al., 2021). Our findings clarify that the value-relevance of these factors depended on the shareholders' exposure to financial risks.[6] In a standard evaluation setting, the stock price would only reflect the firms' own fundamentals. Instead, we find that the price is affected by spillover effects from the institutions' other portfolio holdings, consistent with fire sales across equities.

Third, the negative association of stock returns and IO holds even controlling for changes in earnings forecasts, as captured by analyst revisions. This suggests that stocks held more by institutions experienced a larger wedge between stock price changes and revisions in earnings fundamentals. Moreover, we find that institutions did not disproportionately hold firms at the beginning of the crisis that analysts later expected to have worse earnings performance.

In the next part of the paper, we study how institutions recomposed their portfolios as the crisis was unfolding. If institutions were the driving force behind the stock price drops, we should observe that the stocks with more negative returns experienced a stronger decrease in IO in the first quarter of 2020.[7] Consistent with this, we find that the firm-level IO changes

[6]This result is similar in spirit to the propagation of the GFC shock from bank stocks most affected by the original subprime mortgage shock to nonfinancial stocks owned by the same funds (Hau and Lai, 2017).

[7]The first quarter of 2020 is a plausible time frame to assess IO holdings changes in response to the COVID-19 crisis. The first report of cases of pneumonia detected in Wuhan, China, was issued to the WHO

in 2020-Q1 were significantly positively associated with contemporaneous stock returns. Changes in IO in 2020-Q1 were more pronounced and skewed in the negative direction than in earlier quarters. This is indicative of the unusual selling activity by institutions triggered by the outbreak of the pandemic.

The portfolio re-composition by institutions was geared towards more financially resilient firms. IO fell more in firms with weak corporate financials (higher leverage and lower cash holdings), suggesting that institutions were the marginal investors influencing the stock price changes associated with these corporate characteristics. Interestingly, IO changes are not associated with firms' ES performance.[8] However, certain types of institutional investors sold more indiscriminately, presumably in the attempt to deleverage. In particular, we find that hedge funds sold more than 4% of their aggregate equity portfolio as of the previous quarter.[9] Overall, we conclude that, during the COVID-19 crash, institutional investors in the aggregate expressed a preference for financial resiliency.

The aggregate selling by institutions implies that other groups of investors took the opposite side of those trades. Individual investors -- which are often approximated as 100% minus IO (e.g., Koijen et al., 2020) -- are the most likely candidates. To probe how plausible it is that individual investors provided liquidity to stocks that institutions exited, we employ a newly available proxy: the changes in popularity of stocks on the retail trading platform

on December 31, 2019. After the market swings in the middle of March 2020, two major policy interventions occurred at the end of the first quarter (the Fed's March 23 announcement to intervene in the corporate bond market and the passage of the CARES Act on March 27).

[8]While not our main focus, these results are interesting in light of some contemporaneous work showing that firms with strong environmental and social (ES) performances did better in the crisis (Albuquerque et al., 2020; Garel and Petit-Romec, 2020), though this result has been the subject of some debate (Demers et al., 2021; Mahmoud and Meyer, 2020). For mutual funds, too, the findings are partially contradictory (Pástor and Vorsatz, 2020; Döttling and Kim, 2020).

[9]Schrimpf et al. (2020) show that hedge funds massively sold even high-quality Treasury bonds.

Robinhood Markets Inc. (RH). This commission-free trading app had more than 10 million users as of year-end 2019 and received substantial news coverage especially during the COVID-19 crisis.[10] We find that the change in the number of RH investors in individual stocks over the first quarter of 2020 indeed exhibited opposite patterns to the changes in IO. In particular, in March 2020, retail interest substantially increased for stocks with high leverage and low cash holdings.

Finally, did institutional investors revert their trades in the second quarter of 2020? We find no reversal in institutions' risk-averse strategies, despite the injection of liquidity by the Fed and the aggregate market rally. Institutions continued tilting their portfolios towards firms that entered the pandemic with strong financials. We interpret this result as a signal of the still elevated concerns by institutional investors with respect to economic growth and excess corporate debt. Robinhood users also continued expressing complementary preferences to their institutional counterparts.

We do, however, observe a moderate reversal of stock returns. Specifically, stocks that had the largest decline in IO in the first quarter experienced positive returns in the second quarter of 2020. This pattern is consistent with other investors picking up temporarily undervalued shares as expected following a fire sale (Coval and Stafford, 2007), although a potentially confounding effect emanates from the substantial interventions by the Fed.

Our paper relates to three major strands of literature. First, it contributes to the understanding of institutional investors' behavior during crisis episodes. On the one hand, institutional investors are sophisticated professional investors that improve stock market

[10]Wall Street Journal, ''Free Trading Couldn't Have Come at a Worse Time'' (March 13, 2020), Wall Street Journal, ''Coronavirus Turmoil, Free Trades Draw Newbies Into Stock Market'' (April 29, 2020), Financial Times, ''Gamified Investing Leaves Millennials Playing with Fire'' (May 6, 2020).

efficiency (Sias and Starks, 1997; Boehmer and Kelley, 2009; Campbell et al., 2009; Hendershott et al., 2015; Bai et al., 2016) and corporate governance (Dasgupta et al., 2020). On the other hand, institutional investors could all trade in the same direction and "herd" (Nofsinger and Sias, 1999; Sias, 2004). Coval and Stafford (2007) show that institutional investors can put downward pressure on prices when they are forced to fire sell their assets due to massive redemptions.[11] During the GFC, stocks held by more short-term institutional investors or more hedge funds performed worse (Cella et al., 2013; Ben-David et al., 2012). Moreover, those institutional investors that behaved as liquidity suppliers ceased to do so during the GFC (Anand et al., 2013). However, in the instance of a purely exogenous disaster such as the terrorist attacks of September 11, institutional investors acted as a stabilizing force (Chen et al., 2019). The results on the GFC, while intriguing, thus potentially are affected by the endogeneity of the GFC itself. Our results using the exogenous pandemic shock provide clearer evidence of a fire sales channel, whereby institutional investors experiencing outflows and de-risking their portfolios towards more financially resilient firms magnified the COVID-19 stock market crash. Importantly, we are able to show which specific firm characteristics -- namely low leverage and high cash holdings -- institutional investors associated with "quality" during a tail risk event.[12]

Second, by complementing the analysis of institutional investors' behavior with an analysis of the behavior of retail investors, our paper also contributes to the literature on individual investor behavior during crises. Barrot et al. (2016), for instance, show that individual

[11]Several subsequent papers emphasize this fire sales channel. For example, Greenwood and Thesmar (2011) document that firms with more concentrated ownership structure or owners that face correlated liquidity shocks are more "financially fragile" and exhibit higher price volatility.

[12]For work on "flight to quality" see, e.g., Bernanke et al. (1996) and Caballero and Krishnamurthy (2008).

investors provide liquidity to the stock market during times of market stress (and are compensated for doing so). We further elucidate the role of individual investors as liquidity providers during market crashes. In particular, we provide evidence that individual investors showed increased interest in stocks with weak financials during the COVID-19 stock market crash, thereby providing liquidity that helped to reduce the effects of the fire sales externalities induced by their institutional counterparts.[13]

Third, our research contributes to the rapidly emerging literature that investigates the determinants of investor reactions to COVID-19 and the related implications in terms of corporate finance.[14] Haddad et al. (2021) examine fire sales in corporate bond market while a few other studies have documented the stock-price effects of the level of IO in the COVID-19 crash, without going deeper into the channels through which these effects occurred.[15] Our paper is the first to identify the role of fire sales in equity markets by analyzing actual portfolio changes of institutional investors. Our work also directly contributes to the literature on firms' access to capital during the pandemic, since institutional investors are the largest capital providers.[16]

[13]In contemporaneous work, Ozik et al. (2020) and Welch (2021) also find that RH investors acted as a market-stabilizing force during the COVID market crash. Other studies have looked at 401(k) plan participants (Blanchett et al., 2020), Vanguard clients (Giglio et al., 2020), U.K. retail investors (Ortmann et al., 2020), controlling family shareholders (Amore et al., 2020) and insiders (Anginer et al., 2020).

[14]Early studies on US stock price reactions include (in alphabetic order) Albuquerque et al. (2020), Alfaro et al. (2020), Gormsen and Koijen (2020), Landier and Thesmar (2020), Pagano et al. (2020), and Ramelli and Wagner (2020). Early international studies include Ding et al. (2020), Gerding et al. (2020), and Ru et al. (2020).

[15]In an international sample, Ding et al. (2020) find that in weeks when the number of cases goes up, stock prices fall less for firms with non-financial corporate blockholders and higher hedge fund ownership. Garel and Petit-Romec (2020) find that the relative outperformance of firms with greater environmental scores occurs in firms with higher ownership by long-term investors. For Japanese firms, Takahashi and Yamada (2021) find that ownership by traditional business groups is positively associated with abnormal returns.

[16]Acharya and Steffen (2020) document the corporate "dash for cash" in terms of drawdowns of preexisting credit lines. Li et al. (2020) find that banks acted as lenders of first resort for firms in search of liquidity. Halling et al. (2020) find that the capital raised by US firms in the first quarter of 2020 via equity issues was approximately just 5% of capital raised via bond issues. Carletti et al. (2020) focus on the financing needs and equity erosion during the pandemic of SMEs.

2 Data

Our main sample consists of non-financial constituents of the Russell 3000 index as of the end of 2019-Q4. Table A1 in the Appendix provides detailed variable definitions.

2.1 Institutional and retail investor data

We retrieve firms' institutional ownership data from 2018-Q4 through 2020-Q2 from Factset (Ferreira and Matos, 2008). IO_{2019Q4} is the percentage of a stock's outstanding shares held by institutional investors derived from 13-F form filings as of quarter-end 2019-Q4.[17] In line with common practice in the literature, we truncate institutional ownership at 100% (Gompers and Metrick, 2001). We compute $\Delta\ IO_{2020Q1}$ as the change in institutional ownership from 2019-Q4 to 2020-Q1, trimmed at the 1% and 99% percentiles to control for extreme values.

Since we are interested in examining investor heterogeneity, we classify institutional investors along different non-mutually exclusive categories based on their investment horizon, activeness, origin, and net flows during the GFC. *PassiveIO* is the level of ownership held by passive investors (index funds and ETFs). *Long-TermIO* is the percentage of a stock's outstanding shares held by investors classified as having ''very low'' or ''low'' turnover. The turnover measure is calculated by Factset based on the transactions and market value of an investor, in the spirit of Gaspar et al. (2005).[18] *ForeignIO* is the level of ownership held by non-domestic investors (Ferreira and Matos, 2008).

[17]Institutions with investment discretion over USD 100 million or more of US publicly traded equity securities are required to disclose their holdings to the Securities and Exchange Commission (SEC) via 13-F form filings at the end of each calendar quarter.

[18]Factset calculates the turnover of an investor by dividing the absolute value of the total stock purchases (or sales if they are lower) in a given quarter by the average assets during the quarter. As of Q4-2019, an investor is classified as having ''very low'' or ''low'' turnover if her turnover ratio is below 0.125 per quarter.

We also calculate other portfolio-level investor characteristics to test the "fire sales" channel. *LowFlowsInGFC IO* is the level of ownership by institutional investors who experienced investor flows in the bottom tercile (that is, the highest outflows) during the GFC.[19] *LowFlowsIn2020Q1 IO* is the level of ownership by institutional investors who experienced investor flows in the bottom tercile during the first quarter of 2020.[20] *HighLeverage IO* and *LowCash IO* are the levels of ownership by institutional investors with above-median portfolio exposure to *Leverage* and below-median portfolio exposure to *Cash/assets*, respectively.[21]

Our main focus is on institutional investors, but we also consider the trading behavior of retail investors to better understand who is on the opposite side of institutional investor trades. While retail investor holdings are usually estimated as 100% minus IO holdings, there are also other groups of shareholders (e.g., insiders and control shareholders). There are no detailed holdings data for small retail investors as they are not subject to a regulatory filing requirement like the 13-F form for institutional investors. A newly available data source, however, provides some insights into retail investor behavior.

Specifically, as a proxy for retail interest in a stock, we utilize data from Robinhood Markets Inc. (RH). RH was the first brokerage with zero-commission trades and over 10

[19]We calculate *LowFlowsInGFC IO* in two steps. First, we compute flows during the GFC for each institutional investor as the change in total disclosed equity assets between December 2007 and June 2009 scaled by total disclosed equity assets in December 2007. We adjust the change in total equity assets for stock price changes during the period of the crisis and winsorize the resulting flows at the 1% and 99% percentiles. Second, we construct a stock-level variable that gives the percentage of outstanding shares held by institutional investors with below- or above-median flows during the GFC.

[20]We calculate *LowFlowsIn2020Q1 IO* based on the disclosed equity assets between December 2019 and March 2020. See the previous footnote for details on how we calculate the flows.

[21]We calculate *HighLeverage IO* and *LowCash IO* by first computing a value-weighted portfolio exposure based on the given firm characteristic (as of 2019Q4) for each institutional investor. We then construct a stock-level variable that captures the percentage of outstanding shares held by institutional investors with below- or above-median portfolio exposure to the given firm characteristic.

million users traded on this electronic platform at the end of 2019.[22] Robinhood investors tend to be young (median age of 30) and have between US$ 1,000-5,000 in their brokerage account. While individuals trading on this platform may not be fully representative of the full population US retail investors, they still constitute a large fraction of active individual investors. Data on the amounts invested in individual stocks are not available, but RH provided data on the number of accounts that held a given stock in real-time.[23] We compute the variable *%Δ log(RHusers) 2020Q1* as the percentage change of log Robinhood users invested in a given stock between December 31, 2019, and March 31, 2020. In additional analysis, we also consider the daily changes in RH users.

2.2 Stock returns, analyst forecasts, and firm characteristics

Firms' stock data are from Compustat Capital IQ's North America Daily database. Our stock return data cover the period between February 24 and March 20, 2020, which we label as the *Fever* period following Ramelli and Wagner (2020).[24] Monday, February 24 is a natural starting point for that period as on Sunday February 23, the first major intervention in a Western economy occurred as Italy placed almost 50,000 people under strict lockdown not far from the country's main economic center of Milan. Friday, March 20 is a natural end point, because on Monday, March 23 the Federal Reserve Board announced major interventions in the corporate bond market. The cumulative return in *Fever* is computed by compounding

[22]This falls short of Charles Schwab's 12 million, but substantially exceeds E-Trade's 5 million and Morgan Stanley's 3 million accounts (Tech Crunch, ''As Morgan Stanley buys E-Trade, Robinhood preps social trading'', February 20, 2020).

[23]The popularity data was compiled by Robintrack (`https://robintrack.net/data-download`) but the service has since been discontinued (Bloomberg, ''Robintrack, Chronicler of Day Trader Stock Demand, To Shut'', August 7, 2020).

[24]Gormsen and Koijen (2020) and other papers use a similar timeline.

the daily returns (adjusted for dividends and stock splits) over this period. *Market beta* is computed based on regressions of daily excess returns in 2019 on a constant and the daily market factor.[25] *Stock illiquidity* is the Amihud illiquidity measure computed as the daily ratio of the absolute value of the return to the dollar volume (in million), averaged over all trading days in 2019.

We complement stock data with accounting data from Compustat's North America database and analyst forecast data from I/B/E/S. We use accounting data from the latest 2019 quarterly results referring to periods ending before January 1, 2020. All accounting variables in our analyses are, therefore, predetermined for stock returns.[26] Based on the I/B/E/S database, we also compute the changes over the *Fever* period in analysts' earnings forecasts. Specifically, we compute the change in mean EPS forecasts between February 20, 2020, and March 19, 2020, normalized by the stock price on December 31, 2019, and multiply it by 100. For each firm, we focus on three different forecasting horizons: 2020 (accounting year ending in Q2-2020), 2021, and 2022. We trim the forecast revisions at the 1st and 99th percentiles.

We obtain information on firms' environmental and social (ES) performance from two distinct sources. First, we employ MSCI's Intangible Value Assessment (IVA) database, which has been used in several academic studies (e.g., Liang and Renneboog, 2017). We define the variable *ES (msci)* as the average of the MSCI IVA's scores on the environmental

[25]For robustness checks, we also compute capital asset pricing model (CAPM)-adjusted returns as the daily excess return on the stock minus the stock's beta times the market excess return. Similarly, we compute Fama-French-adjusted returns as the daily excess return on the stock minus its factor exposures times the factor returns, where the factor exposures are computed on daily market excess return, size, and value factor returns (obtained from Kenneth French's website) throughout 2019.

[26]A robustness check shows that our results remain unchanged when using accounting data not only *referring* to periods ending before January 1, 2020, but also *reported* before that date.

and the social pillar in 2018, before our period of analysis. For robustness, we alternatively employ the environmental and social scores from Thomson Reuters Refinitiv (Asset 4), used by Albuquerque et al. (2020).

2.3 Descriptive statistics

Table 1 provides some descriptive statistics. The average firm in the sample has cumulative returns in the *Fever* period of −39%, a market capitalization of US$ 2,241 million, and institutional ownership of 80% as of quarter-end 2019-Q4. With respect to the different institution types, we find that, on average, passive ownership is 21%, long-term ownership is 64%, and foreign ownership is 11%. We further notice that the average firm is held by 3,500 users of the Robinhood retail trading platform, with large variation across firms.

Table 1 about here

3 Stock prices and institutional ownership

3.1 Main effects of institutional ownership

To examine the stock price effects of institutional ownership, we regress the cumulative stock returns over the *Fever* period (from February 24, 2020 through March 20, 2020) on the level of institutional ownership and firm characteristics (*Leverage*, *Cash/assets*, *Market beta*, *Stock illiquidity*, *log(Market cap)*, *Profitability*, *Book-to-market*) as of year-end 2019 and industry fixed effects.

The regression results in column (1) in Table 2 show that firms with higher institutional

ownership at the end of the year 2019 experienced worse stock price drops during the COVID-19 crash.[27] Economically, a one standard deviation higher IO_{2019Q4} corresponds to one-tenth lower standard deviation in cumulative *Fever* returns. This effect is sizable and quite similar in magnitude to the effects of one standard deviation differences in *Cash/assets* and *Leverage*, two features that prior literature has identified as key drivers of stock price performance in the COVID-19 crisis. As Figure 1 indicates, in the early phases of the outbreak (even after human-to-human transmission of the novel coronavirus was confirmed on January 22, 2020), IO was not significantly associated with stock returns. A large part of the effect of IO comes from the last week of the *Fever* period, when stock prices experienced a dramatic decline.

Table 2 about here

Our set of control variables aims to capture stock and fundamental characteristics that could be potential drivers of the stock returns in 2020-Q1 and also be correlated with the level of institutional ownership. For example, previous literature has shown that institutional investors prefer larger (Falkenstein, 1996) and more liquid stocks (Amihud, 2002; Pástor and Stambaugh, 2003; Acharya and Pedersen, 2005). We control for those variables and also other common firm characteristics. Interestingly, the positive coefficient on *Stock illiquidity* in Table 2 is yet another indication of the negative market-wide liquidity shock brought by COVID-19, which affected more the price of the ex-ante more liquid stocks. This finding is consistent with the stock price effect of stock illiquidity during the GFC (Lou and Sadka, 2011).[28]

[27] In addition to controlling for industry fixed effects, we also ensure that all our findings remain qualitatively unchanged when excluding the energy (GICS sector = 10) and IT stocks (GICS sector = 45) from the sample, i.e., the industries that fared worst and best during the COVID crash.

[28] Our results remain unchanged also when controlling for a stock's liquidity risk exposure (also known

In column (2) of Table 2 we add the corporate environmental and social scores to the regression. Consistent with Albuquerque et al. (2020), firms with higher *ES score (msci)* had a higher stock performance during the *Fever* period.[29] Despite the smaller sample size, the impact of IO is unaffected by controlling for ES scores.

We then examine investor heterogeneity in terms of activeness, horizon, and domicile. Column (3) of Table 2 indicates that a higher percentage of $PassiveIO_{2019Q4}$ is associated with more resilience.[30] Column (4) indicates that a higher percentage of long-term institutional ownership is associated with relatively better stock price performance. This result on $LongtermIO_{2019Q4}$ is consistent with Cella et al. (2013) on the amplification of market shocks by short-horizon investors. Column (5) indicates that US stocks with higher foreign IO experienced better stock price performance. The result on $ForeignIO_{2019Q4}$ is in line with Choe et al. (1999), who show that foreign investors do not destabilize markets, and with Kacperczyk et al. (2018), who show that foreign ownership increases market liquidity. Ferreira et al. (2018) also suggest that foreign investors can provide a benefit as they have fewer outflows during market downturns.

as liquidity beta), computed by regressing daily stock returns in 2019 on the Fama-French factors and the value-weighted Amihoud illiquidity measures of the market, in the same spirit of Lou and Sadka (2011). In results available upon request, we also ensured that all our results remain unchanged when controlling for firms' payout ratio in 2019 or alternatively over the previous five fiscal years. We computed the payout ratio as total payout (purchase of common and preferred stocks plus common and preferred dividends) over total profits (sales minus cost of goods sold), as in Asness et al. (2019). Using the specification in column (1) of Table 2, the estimated effect of the payout ratio (in 2019 or in the previous five years) on the Fever returns is positive but statistically insignificant.

[29]We obtain similar results when employing the ES scores from Thomson Reuters Refinitiv. The stock price effect of sustainability scores is open to different interpretations because ES(G) may be correlated with institutional ownership (Nofsinger et al., 2019) and, ex ante, it is not clear whether firms with larger or smaller institutional ownership do better in the crisis. Our findings show that the positive effect of ES(G) holds even after controlling for differences in ownership structure just before the onset of the crisis.

[30]This finding speaks to anecdotal arguments regarding the stabilizing role of some types of passive funds, especially target-dated retirement funds, which by construction rebalance their portfolios counter-cyclically to maintain their asset allocation mix unchanged. See Bloomberg, ''This Market Leviathan Dwarfs the Nasdaq Whale'', October 1, 2020.

Overall, these tests show that higher institutional ownership before the crisis was negatively associated with stock price performance during the COVID-19 crash. The finding that this relation is particularly pronounced when there are more active and more short-term investors suggests that the price changes were caused by trades of actively managed institutional portfolios. We next conduct more specific tests regarding potential institutional fire sales.

3.2 Evidence on institutional fire sales

Why is institutional ownership a key explanatory variable for stock returns in the COVID-19 crash? A possible interpretation is that the stock price drop in the *Fever* period was driven by institutional owners in what amounts to a "fire sale," asset sales at a discount in reaction to a fundamental shock that trigger further sales (Coval and Stafford, 2007; Shleifer and Vishny, 2011). Two factors are likely behind institutional fire sales: 1) the sudden increase in redemption risks, urging institutional investors to decrease the total size of their equity exposure, and 2) an attempt of institutional investors to de-risk their portfolios by re-balancing towards firms better prepared to deal with the pandemic.

Panel A of Table 3 shows that both factors seem to have played a role. Related to the first factor, column (1) indicates that stocks with higher ownership by investors with higher client outflows during the GFC ($LowFlowsInGFC\ IO_{2019Q4}$) performed worse. Presumably, these investors, more than 10 years after the GFC, were again facing the risk of having to respond to massive redemptions of their clients in response to COVID-19, and acted accordingly. While outflows during the GFC have the advantage that they are predetermined, it is also interesting to consider contemporaneous investor withdrawals. Column (2) shows that stocks

performed worse when they were held more by institutional investors that experienced large outflows during 2020-Q1. These findings suggest forced sales to meet liquidity demands (Coval and Stafford, 2007).

Related to the second factor, columns (3) to (6) show that higher ownership by institutional investors with above-median portfolio exposure to high-leverage ($HighLeverageIO_{2019Q4}$) and to low-cash firms ($LowCashIO_{2019Q4}$) is associated with a significant *amplification* of the stock price effects of firms' financial strength.[31] While prior literature has identified financial strength as a major determinant of firms' cash-flow prospects during crises (including during COVID-19), our finding indicates that the financial exposure of institutional investors themselves can create spillover effects on their portfolio companies. Thus, while prior work has highlighted that on average there was a stock price penalty associated with financial weakness, our results suggest that the effect is concentrated among those firms that, besides weak finances, also have institutional investors that are strongly exposed to such type of companies in their portfolios. These results suggest that in this crisis period stock prices were not determined exclusively by an assessment of fundamental values, a feature of a fire sale.

To further develop this idea, we employ a proxy for changes in fundamental values, analyst earning forecast revisions. In Panel B of Table 3, we show that, as expected, stock returns and revisions in mean analysts' earnings forecasts are closely aligned.[32] Importantly,

[31]Other work has examined the cash holdings of institutions themselves. For example, Chernenko and Sunderam (2020) analyze the cash holdings of open-end mutual funds. They find that mutual funds with stronger incentives to limit their impact on price accommodate inflows and outflows by adjusting their cash buffers (instead of trading in portfolio securities). As a result, stocks held by these funds have lower volatility. Similar considerations are derived in Simutin (2014) with respect to equity mutual funds. Ellul et al. (2011) provide evidence of ''fire sales'' effects in corporate bond markets caused by regulatory constraints on insurance companies.

[32]Our definition of forecast revisions follows the approach used, for instance, in Liu et al. (2017). Similar results are obtained when measuring forecast revisions as the percentage change in EPS forecasts excluding observations with negative baseline forecasts (as done, e.g., in Landier and Thesmar, 2020) or when taking the absolute value at the denominator (as in, e.g., Ivković and Jegadeesh, 2004).

however, our results on the effect of IO during the *Fever* period hold even when controlling for earnings forecast revisions. Thus, to the extent that earnings forecast revisions are unbiased, these findings indicate that firms with higher institutional ownership saw a larger wedge between stock prices and earnings fundamentals.

Finally, it is possible that, despite all our controls, the relation between stock prices during the crisis and institutional ownership at the end of 2019 is merely a reflection of institutions being systematically positioned in firms that were ultimately hit harder by the crisis. Figure 2 shows that there is no indication that this actually holds in the data. Specifically, IO at Q4-2019 is uncorrelated with analyst revisions during 2020-Q1 of EPS for 2021. Further results (not shown, but available upon request) show that a similar pattern holds for other horizons.

Overall, these results suggest that institutional investors were major protagonists in the COVID-19 market crash. These investors amplified the stock price crash when they experienced a need to meet liquidity demands by their fund investors and when their ''exposed'' portfolios prompted them to seek shelter in safer positions.

4 Changes in total institutional ownership

This section examines more directly whether institutional owners amplified negative stock moves by studying ownership changes in the first quarter of 2020. To provide some descriptive background, Figure 3 plots, in Panel A, IO changes in 2020-Q1 and compares them against IO changes in 2019-Q4. We observe a highly negative skewed distribution of the firm-level changes in IO in 2020-Q1, indicating an overall divestment of institutional investors from

stocks. This pattern stands in contrast to the average IO change in the prior quarters of 2019, which exhibits a symmetric distribution of buying/selling centered around 0.[33]

Figure 3 about here

4.1 What explains institutional ownership changes?

In this subsection, we explore the cross-section of changes in institutional ownership during the COVID-19 crisis. If institutions were behind the stock price drops, then we would observe that stocks with more negative returns exhibit stronger decreases in institutional ownership during the first quarter of 2020. We also examine how investors re-balanced their portfolios in a response to the shock.

Table 4 about here

First, in columns (1) and (2) of Table 4, we observe that the stock performance in the *Fever* period strongly explains the change in institutional ownership in 2020-Q1. Specifically, IO drops more in firms that experienced worse stock price performance. This confirms that the price penalty associated with IO is driven by the active trading activity of institutional owners (rather than the alternative that other groups of investors sold particularly aggressively in firms with large institutional ownership).

In the remaining columns of Table 4, we explore the firm characteristics that were important to institutional investors when they re-balanced their portfolios during the first

[33]Online Appendix Figure OA2 shows the distributions of the IO changes in each of the four quarters of 2019. Online Appendix Figure OA3 compares, in Panel A, the distribution of overall IO changes during 2020-Q1 against the distribution of changes in passive IO. As expected, changes in passive IO are less pronounced. Panel B of the same graph displays the change in 2020-Q1 broken-down on whether a Russell 3000 firm is in the S&P 500 or not. Interestingly, the changes are more pronounced for the non-S&P 500 firms.

quarter of 2020. We regress the change in IO over the 2020-Q1 quarter (Δ *IO 2020Q1*) on firm characteristics. In column (3), we observe that institutional ownership decreased in high-leverage and low-cash firms, as well as in value and smaller firms. Adding the prior level of IO (IO_{2019Q4}, to control for potential mean reversion effects) changes the coefficients only mildly; see column (4). Firms with one standard deviation higher leverage experienced a 6% of a standard deviation stronger reduction in institutional ownership (-0.009 $\times$ 22.7/3.22).

In column (5), we add firms' ES scores (*ES score (msci)*). The statistical significance of the coefficients on *Leverage* and *Cash/assets* is reduced due to the smaller sample size. We find no evidence that institutional investors have tilted their portfolios toward firms with higher environmental and social performance. Presumably, the stock-price premium associated with the ES score during the COVID-19 crash is not driven by a demand pressure coming from institutional investors. These results suggest that institutional investors, at least in times of crisis, prefer hard resiliency characteristics over soft firm attributes.[34]

Panel B of Figure 3 illustrates these results, plotting the relation between the net change in institutional ownership in 2020-Q1 and firm leverage, cash holdings, and environmental and social (ES) scores.[35] In sum, institutional investors reacted to COVID-19 by significantly pulling out from corporations that were ex-ante financially weak.

Note that, in normal times, it is difficult to identify the preferences of institutional investors for firms' financial policies because these policies are endogenously set by corporate managers also considering the level of firms' access to institutional capital on the equity market. As a result, the relation between changes in institutional ownership and financial

[34]In results available upon request, we obtain similar inferences when employing the ES scores from Thomson Reuters Refinitiv.

[35]The figures do not control for industry fixed effects to provide additional information relative to Table 4. The figures look quite similar when including fixed effects.

policy decisions is the result of a mix of both endogenous decisions by corporations and institutional investors' portfolio choices.[36] Since COVID-19 is an exogenous shock it offers an opportunity to exploit the portfolio reshuffling by institutional investors to infer their revealed preferences for firm characteristics.

4.2 Placebo tests

Overall, the results shown thus far indicate that (beyond what is reflected in prices) institutional investors fled leverage, exhibited a preference for cash, and showed indifference towards ES scores. In this subsection, we comment on two placebo tests to probe whether this behavior is special to this tail risk phase and a matter of active IO response. These results are tabulated in the Online Appendix.

First, in Table OA1 in Panel A, we re-estimate the regressions in Table 4 using only the subsample of S&P 500 constituents as of January 2020. Since the S&P 500 is a popular index for indexed funds and ETFs (and many active investors also use it as a benchmark), a large fraction of institutions do not sell these holdings in order to track the index performance. In other words, S&P 500 companies have a large exogenous component in demand (Harris and Gurel, 1986; Shleifer, 1986; Koijen and Yogo, 2019). Therefore, we expect stocks that are part of the S&P 500 to be less likely to experience large changes in institutional ownership, regardless of the fact that their specific characteristics led them to experience lower or higher abnormal returns. Indeed, we find that S&P 500 firms with high leverage and low cash holdings, despite having incurred stock price losses, did not experience significant net outflows

[36] Grennan et al. (2017) empirically investigate the links between institutional ownership and capital structure decisions.

of institutional ownership.

Second, in Panel B of Table OA1, we focus again on the full Russell 3000 sample, but we look at the change in passive institutional ownership (the percentage of stocks held by institutional investors that are index funds and ETFs). Given the nature of passive investors, we expect no significant changes in their ownership ratios on the basis of firm characteristics. The regression results confirm this intuition.

4.3 Portfolio changes by investor category

Institutional investors can change their portfolios -- and, as a result, influence stock market valuations -- in two main ways: By adjusting the total size of their equity portfolio or by changing portfolio weights, i.e., their relative position in each firm. In this section, we examine how different investor types changed their equity portfolios during 2020-Q1 along these two dimensions.

We first compute how the total equity position of each type of investors changed in 2020-Q1. For this analysis, we compute a measure of *active* change of the equity portfolio, that is, the change that is not due to changes in market valuations of individual stocks. Specifically, we compute this measure as: $\Delta Equity\ positions_{i,2020Q1} = \sum_{j \in S}(IO_{i,j,2020Q1} - IO_{i,j,2019Q4}) \times Market\ cap_{j,2019Q4}$, where S denotes the set of firms in our sample, i denotes the category of institutional investors, $IO_{i,j}$ denotes the percentage of total stocks of firm j held by the investor category i. $Market\ cap_{j,2019q4}$ is the market capitalization of firm j as end of 2019-Q4. In other words, this measure captures how much of the equity positions as of 2019-Q4 changed during 2020-Q1 keeping stock prices constant.

Illustrating the change in equity positions, Figure 6 shows that the behavior of institutional investors during 2020-Q1 is heterogeneous. In particular, hedge funds appear to have divested around USD 100 billion of their 2019-Q4 equity positions during 2020-Q1, equal to approximately 4.4% of their assets under management at that time.[37] Hedge funds divested significantly more in absolute and relative numbers than pension funds, mutual funds, or investment advisors.

Figure 6 about here

In Table 5 we study the determinants of the change in stock ownership by investor category. Column (1) shows that hedge funds appear to have deleveraged by selling stocks that performed relatively well during the Covid crash. These investors have not undertaken a significant portfolio re-balancing towards more financially resilient firms (see Columns (2) and (3)). Presumably, they decreased their portfolio leverage by trying to sell ''everything'' in their portfolios, perhaps even starting from the most easy-to-sell stocks. By contrast, Columns (4) to (6) show that institutional investors other than hedge funds appear to have discriminated between firms on the basis of their financial positioning, in line with the results in Table 3. Notably, once we separate out hedge funds, leverage is a significant determinant of IO changes again, even in the smaller sample where we have ES data.

Table 5 about here

If institutions behaved (in aggregate) as net sellers, especially for more financially fragile stocks, which market participants took the other side of their trades? Did individual investors

[37]This estimate is consistent also with the numbers provided by market participants and investment platforms, see Pension and Investments, ''Hedge fund industry AUM slips below USD 3 trillion'' (April 22, 2020).

act as liquidity providers, hence revealing heterogeneous preferences from their institutional counterparts? Columns (7) to (9) in Table 5 investigate the cross-sectional effects of firm characteristics on the percentage change in (the log of) Robinhood users in 2020-Q1 on firm characteristics. Effectively showing the flip side of the behavior of institutional investors, retail investors bought high-leverage and low-cash firms and invested particularly in firms that experienced worse stock performance.[38] From column (8), a one standard deviation higher leverage led to a 6% of a standard deviation higher increase in popularity among retail investors (-0.041 $\times$22.7/15.14).

Panel A of Figure 4 shows that there is a strong negative correlation between the change in IO in a stock and the change in retail investor interest in 2020-Q1. Panel B offers an industry-by-industry analysis. Two findings emerge. First, Δ *IO 2020Q1* is negative in each industry, whereas *%*Δ *log(RHusers) 2020Q1* is positive in each industry. Second, institutional investors reduced holdings the most in those industries which were most favored by retail investors. Overall, these results are in line with Barrot et al. (2016), who find that retail investors provide liquidity when institutional liquidity providers are constrained.

Figure 4 about here

Figure 5 shows the day-to-day evolution of retail investor interest in cash, leverage, and ES performance during 2020-Q1. Using the granularity of the Robinhood data, we rerun our baseline regressions in Panel B of Table 4 for each day using the year-to-date percentage change in Robinhood users. We notice that Robinhood users show an increasing interest

[38]The heterogeneity in the reactions to COVID-19 among different types of investors relates to the literature studying how heterogeneous preferences and behaviors across investor types affect market valuations. In particular, Koijen and Yogo (2019) and Koijen et al. (2020) develop a demand system asset pricing approach to estimate the demand of investors for various firm characteristics and understand their relative influence in the price formation process.

for low-cash and high-leverage firms after March 11, 2020. These changes in retail investor interest align with the institutional-related stock price drop shown in Figure 1, which provides further evidence that retail investors moved into the high-leverage and low-cash stocks that institutional investors were selling during the *Fever* period.[39]

Figure 5 about here

5 Did investors reverse their trading in Q2-2020?

The main focus of this paper is to analyze the investor behavior during the first quarter of 2020, when the COVID-19 shock caused extreme uncertainty in financial markets. What happened beyond the initial crisis phase is also of interest, however, as it may reveal something about the mechanisms behind the effects observed in the crisis. In particular, a classic feature of a fire sale is the reversal of trading decisions after the crisis (Coval and Stafford, 2007).

The analysis of investor behavior over the second quarter of 2020 has to take into account that the Fed's announced massive interventions on March 23 and significantly expanded those interventions on April 9. The Fed's promise of massive injection of liquidity (D'Amico et al., 2020; Haddad et al., 2021) reassured investors and paved the way for a swift reversal of major stock indexes. The second quarter of 2020 was regarded in the financial press as a period of overall stock market exuberance, but individual companies fared unequally.[40] By June 30, 2020, only 28% of the firms in our sample had fully recovered from the losses of

[39]Robinhood trader interest in firms with high ES scores decreased after March 16, 2020. We do not interpret this result as necessarily indicating that all retail investors moved away from these stocks, as Moss et al. (2020) find (for the pre-COVID period) that Robinhood traders actually do not respond to ESG disclosures.

[40]In fact, by the Summer of 2020 the S&P500 index made its fastest-ever recovery from a bear market (Wall Street Journal, "S&P 500 Sets First Record Since February, Erasing Its Coronavirus Plunge" (August 18, 2020)).

the *Fever* period (showing cumulative returns from the beginning of 2020 above zero). The median cumulative return in the second quarter is 24%, but with a standard deviation of 44%. In this section, we study the behavior of institutional investors during this time.

When looking at changes in IO of individual firms (Online Appendix Figure OA4), we observe that, while some firms continued experiencing a net outflow of institutional capital, several firms actually experienced a significant *increase* in institutional ownership from the end of the first quarter. The distribution of 2020-Q2 changes in IO is more symmetric compared to 2020-Q1, indicating that institutional investor behavior was more moderate, with both selling and buying occurring in the second quarter.

How should we interpret the portfolio reshuffling in 2020-Q2? If the market performance in 2020-Q2 was indeed the start of a ''recovery phase'', i.e., a comeback of corporate valuations to their pre-crisis levels, we would expect firms that lost most IO in the first quarter to be those that saw it increase the most during the second quarter. In other words, we would expect institutional investors to reverse the divestment they made in 2020-Q1.

The data, however, seem to indicate the opposite. Panel A of Figure 7 displays a positive correlation between IO changes in 2020-Q1 and 2020-Q2, suggesting that institutional investors kept buying the same stocks in 2020-Q2 as in 2020-Q1 (albeit in a less pronounced fashion). Consistent with this, Table 6 and Online Appendix Figure OA6 document that institutional investors in 2020-Q2 continued shifting their portfolios towards high-cash and low-debt firms. Studying the holdings of retail investors, we find that Robinhood users kept expressing complementary preferences to their institutional counterparts in 2020-Q2.[41]

[41]Robinhood users kept showing a preference for high-debt firms in 2020-Q2, less so for low-cash firms (Online Appendix Figure OA7). We further notice that Robinhood users uniformly increased their investments across all industries (Panel B of Online Appendix Figure OA5).

Figure 7 about here

Table 6 about here

Nevertheless, we find some evidence of stock price reversals in 2020-Q2. Panel B of Figure 7 shows that firms that saw a larger decline in IO during 2020-Q1 (a more negative Δ IO 2020Q1) did experience some stock price reversal during 2020-Q2, net of the effect of other firm characteristics. This reversal could be consistent with a correction of potential 2020-Q1 fire sales externalities. The positive abnormal returns in 2020-Q2 would compensate those who provided liquidity in the crisis period. This could have been driven in particular by non-institutional investors given that we find no evidence that institutional investors bought back the stocks that they sold earlier. However, this return reversal pattern is possibly driven by the targeted initiatives deployed by the Fed to support the credit markets (illustrated with the red bars).

Overall, our results indicate that in the second quarter of 2020 institutional investors did not revert their portfolios to the pre-COVID status, despite a massive injection of liquidity by the Fed and the aggregate market rally. In particular, the fact that institutional investors did not relax their concerns on financially weak firms is a signal of the uncertainty that prevailed among financial market participants at the time with respect to economic growth and corporate debt.

6 Conclusion

The long-term impact of COVID-19 on corporations and their responses depends on the preferences of their shareholder base. It is, therefore, essential to understand the role of

institutional and other investors in the COVID-19 stock market collapse. We document that institutions valued financial resiliency (high cash and low leverage) to insure their portfolios against the indeterminate duration of the cash flow shortfall. We find that active institutional investors were the marginal investors on these firm characteristics, as their quarterly portfolio changes were associated with cross-sectional patterns in stock returns. Conversely, ''soft'' characteristics such as those captured by ESG scores do not appear to have generated extra interest from institutional investors, at least in aggregate.

The combination of institutional deleveraging (especially by hedge funds) and a run for more financial resilient firms created fire sales externalities, amplifying the price crash induced by the fundamental deterioration on the outlook of many companies. We also provide evidence that retail investors increased their interest in more financially fragile firms, hence providing liquidity and revealing significantly more risk tolerance than their institutional counterparts in times of crisis. Understanding these differences across institutional and retail investors' behavior during the pandemic is particularly relevant also from a public policy perspective.

The result that when a tail risk realizes, institutional investors can amplify price crashes by fire-selling has important consequences for corporations. In particular, it implies that companies should be mindful of their shareholder base, including the stock price fragilities deriving from the broader portfolio positions of their investors.[42]

[42]Evidence in Friberg et al. (2020) suggests that firms indeed respond to their own stock price fragilities by taking precautionary actions in terms of higher cash holdings and lower expenditures.

References

Acharya, Viral V., and Lasse Heje Pedersen, 2005, Asset pricing with liquidity risk, *Journal of Financial Economics* 77, 375--410.

Acharya, Viral V., and Sascha Steffen, 2020, The risk of being a fallen angel and the corporate dash for cash in the midst of COVID, *Review of Corporate Finance Studies* 9, 430--471.

Albuquerque, Rui A., Yrjo Koskinen, Shuai Yang, and Chendi Zhang, 2020, Resiliency of environmental and social stocks: An analysis of the exogenous COVID-19 market crash, *Review of Corporate Finance Studies* 9, 593--621.

Alfaro, Laura, Anusha Chari, Andrew N. Greenland, and Peter K. Schott, 2020, Aggregate and firm-level stock returns during pandemics, in real time, Working Paper.

Amihud, Yakov, 2002, Illiquidity and stock returns: Cross-section and time-series effects, *Journal of Financial Markets* 5, 31--56.

Amore, Mario Daniele, Valerio Pelucco, and Fabio Quarato, 2020, Family ownership during the COVID-19 pandemic, Working Paper.

Anand, Amber, Paul Irvine, Andy Puckett, and Kumar Venkataraman, 2013, Institutional trading and stock resiliency: Evidence from the 2007--2009 financial crisis, *Journal of Financial Economics* 108, 773--797.

Anginer, Deniz, Anil Donmez, H. Nejat Seyhun, and Ray Zhang, 2020, Global economic impact of COVID-19: Evidence from insider trades, Working Paper.

Asness, Clifford S., Andrea Frazzini, and Lasse Heje Pedersen, 2019, Quality minus junk, *Review of Accounting Studies* 24, 34--112.

Bai, Jennie, Thomas Philippon, and Alexi Savov, 2016, Have financial markets become more informative?, *Journal of Financial Economics* 122, 625--654.

Barrot, Jean-Noel, Ron Kaniel, and David Sraer, 2016, Are retail traders compensated for providing liquidity?, *Journal of Financial Economics* 120, 146--168.

Ben-David, Itzhak, Francesco Franzoni, and Rabih Moussawi, 2012, Hedge fund stock trading in the financial crisis of 2007--2009, *Review of Financial Studies* 25, 1--54.

Bernanke, Ben S., Mark Gertler, and Simon Gilchrist, 1996, The flight to quality and the financial accelerator, *Review of Economics and Statistics* 78, 1--15.

Blanchett, David, Michael S. Finke, and Jonathan Reuter, 2020, Portfolio delegation and 401(k) plan participant responses to COVID-19, Working Paper.

Boehmer, Ekkehart, and Eric K. Kelley, 2009, Institutional investors and the informational efficiency of prices, *Review of Financial Studies* 22, 3563--3594.

Caballero, Ricardo J., and Arvind Krishnamurthy, 2008, Collective risk management in a flight to quality episode, *The Journal of Finance* 63, 2195--2230.

Campbell, John Y., Tarun Ramadorai, and Allie Schwartz, 2009, Caught on tape: Institutional trading, stock returns, and earnings announcements, *Journal of Financial Economics* 92, 66--91.

Carletti, Elena, Tommaso Oliviero, Marco Pagano, Loriana Pelizzon, and Marti G. Subrahmanyam, 2020, The Covid-19 shock and equity shortfall: Firm-level evidence from Italy, *Review of Corporate Finance Studies* 9, 534--568.

Cella, Cristina, Andrew Ellul, and Mariassunta Giannetti, 2013, Investors' horizons and the amplification of market shocks, *The Review of Financial Studies* 26, 1607--1648.

Chen, Yangyang, Gang Hu, Danlei Bonnie Yu, and Jingran Zhao, 2019, Catastrophic risk and institutional investors: Evidence from institutional trading around 9/11, *Pacific-Basin Finance Journal* 56, 211--233.

Chernenko, Sergey, and Adi Sunderam, 2020, Do fire sales create externalities?, *Journal of Financial Economics* 135, 602--628.

Choe, Hyuk, Bong-Chan Kho, and Rene M Stulz, 1999, Do foreign investors destabilize stock markets? The Korean experience in 1997, *Journal of Financial Economics* 54, 227--264.

Coval, Joshua, and Erik Stafford, 2007, Asset fire sales (and purchases) in equity markets, *Journal of Financial Economics* 86, 479--512.

D'Amico, Stefania, Vamsidhar Kurakula, and Stephen Lee, 2020, Impacts of the Fed corporate credit facilities through the lenses of ETFs and CDX, Working Paper.

Dasgupta, Amil, Vyacheslav Fos, and Zacharias Sautner, 2020, Institutional investors and corporate governance, Working Paper.

Demers, Elizabeth, Jurian Hendriks, Philip Loos, and Baruch Lev, 2021, ESG didn't immunize stocks against the COVID-19 crisis, but investments in intangible assets did, *Journal of Business Finance & Accounting* forthcoming.

Dennis, Patrick J., and Deon Strickland, 2002, Who blinks in volatile markets, individuals or institutions?, *The Journal of Finance* 57, 1923--1949.

Ding, Wenzhi, Ross Levine, Chen Lin, and Wensi Xie, 2020, Corporate immunity to the COVID-19 pandemic, *Journal of Financial Economics* Forthcoming.

Döttling, Ola, and Sehoon Kim, 2020, Sustainability preferences under stress: Evidence from mutual fund flows during COVID-19, Working Paper.

Ellul, Andrew, Chotibhak Jotikasthira, and Christian T. Lundblad, 2011, Regulatory pressure and fire sales in the corporate bond market, *Journal of Financial Economics* 101, 596--620.

Fahlenbrach, Rüdiger, Kevin Rageth, and René M. Stulz, 2021, How valuable is financial flexibility when revenue stops? Evidence from the COVID-19 crisis, Working Paper.

Falkenstein, Eric G, 1996, Preferences for stock characteristics as revealed by mutual fund portfolio holdings, *Journal of Finance* 51, 111--135.

Ferreira, Miguel A, Massimo Massa, and Pedro Matos, 2018, Investor--stock decoupling in mutual funds, *Management Science* 64, 2144--2163.

Ferreira, Miguel A., and Pedro Matos, 2008, The colors of investors' money: The role of institutional investors around the world, *Journal of Financial Economics* 88, 499--533.

Friberg, Richard, Itay Goldstein, and Kristine W. Hankins, 2020, Corporate responses to stock price fragility, Working Paper.

Garel, Alexandre, and Arthur Petit-Romec, 2020, Investor rewards to environmental responsibility: Evidence from the COVID-19 crisis, Working Paper.

Gaspar, José-Miguel, Massimo Massa, and Pedro Matos, 2005, Shareholder investment horizons and the market for corporate control, *Journal of Financial Economics* 76, 135--165.

Gerding, Felix, Thorsten Martin, and Florian Nagler, 2020, The value of fiscal capacity in the face of a rare disaster, Working Paper.

Giglio, Stefano, Matteo Maggiori, Johannes Stroebel, and Stephen Utkus, 2020, Inside the mind of a stock market crash, Working Paper.

Gompers, Paul A., and Andrew Metrick, 2001, Institutional investors and equity prices, *The Quarterly Journal of Economics* 116, 229--259.

Gormsen, Niels J., and Ralph S. J. Koijen, 2020, Coronavirus: Impact on stock prices and growth expectations, *Review of Asset Pricing Studies* 10, 574--597.

Greenwood, Robin, and David Thesmar, 2011, Stock price fragility, *Journal of Financial Economics* 102, 471--490.

Grennan, Jillian, Roni Michaely, and Christopher J. Vincent, 2017, The deleveraging of US firms and institutional investors' role, Working Paper.

Haddad, Valentin, Alan Moreira, and Tyler Muir, 2021, When selling becomes viral: Disruptions in debt markets in the COVID-19 crisis and the Fed's response, *Review of Financial Studies* forthcoming.

Halling, Michael, Jin Yu, and Josef Zechner, 2020, Bond and equity issuance activity during COVID-19, *Review of Corporate Finance Studies* 9, 501--533.

Harris, Lawrence, and Eitan Gurel, 1986, Price and volume effects associated with changes in the S&P 500 list: New evidence for the existence of price pressures, *The Journal of Finance* 41, 815--829.

Hau, Harald, and Sandy Lai, 2017, The role of equity funds in the financial crisis propagation, *Review of Finance* 21, 77--108.

Hendershott, Terrence, Dmitry Livdan, and Norman Schürhoff, 2015, Are institutions informed about news?, *Journal of Financial Economics* 117, 249--287.

Ivković, Zoran, and Narasimhan Jegadeesh, 2004, The timing and value of forecast and recommendation revisions, *Journal of Financial Economics* 73, 433--463.

Kacperczyk, Marcin, Savitar Sundaresan, and Tianyu Wang, 2018, Do foreign investors improve market efficiency?, Working Paper.

Koijen, Ralph S. J., Robert Richmond, and Motohiro Yogo, 2020, Which investors matter for equity valuations and expected returns?, Working Paper.

Koijen, Ralph S.J., and Motohiro Yogo, 2019, A demand system approach to asset pricing, *Journal of Political Economy* 127, 1475--1515.

Landier, Augustin, and David Thesmar, 2020, Earnings expectations in the COVID crisis, *Review of Corporate Finance Studies* 4, 598--617.

Li, Lei, Philip E. Strahan, and Song Zhang, 2020, Banks as lenders of first resort: Evidence from the COVID-19 crisis, *The Review of Corporate Finance Studies* 9, 472--500.

Liang, Hao, and Luc Renneboog, 2017, On the foundations of corporate social responsibility, *The Journal of Finance* 72, 853--910.

Liu, Laura Xiaolei, Haibing Shu, and K.C. John Wei, 2017, The impacts of political uncertainty on asset prices: Evidence from the Bo scandal in China, *Journal of Financial Economics* 125, 286--310.

Lou, Xiaoxia, and Ronnie Sadka, 2011, Liquidity level or liquidity risk? Evidence from the financial crisis, *Financial Analysts Journal* 67, 51--62.

Loughran, Tim, and Bill McDonald, 2020, Management disclosure of risk factors and COVID-19, Working Paper.

Mahmoud, Ola, and Julia Meyer, 2020, The anatomy of sustainability, Working Paper.

Moss, Austin, James P. Naughton, and Clare Wang, 2020, The irrelevance of ESG disclosure to retail investors: Evidence from Robinhood, Working Paper.

Nofsinger, John R., and Richard W. Sias, 1999, Herding and Feedback Trading by Institutional and Individual Investors, *Journal of Finance* 54, 2263--2295.

Nofsinger, John R, Johan Sulaeman, and Abhishek Varma, 2019, Institutional investors and corporate social responsibility, *Journal of Corporate Finance* 58, 700--725.

Ortmann, Regina, Matthias Pelster, and Sascha Tobias Wengerek, 2020, COVID-19 and investor behavior, Working Paper.

Ozik, Gideon, Ronnie Sadka, and Siyi Shen, 2020, Flattening the illiquidity curve: Retail trading during the COVID-19 lockdown, Working Paper.

Pagano, Marco, Christian Wagner, and Josef Zechner, 2020, Disaster resilience and asset prices, Working Paper.

Pástor, Ľuboš, and Robert F. Stambaugh, 2003, Liquidity risk and expected stock returns, *Journal of Political Economy* 111, 642--685.

Pástor, Ľuboš, and M. Blair Vorsatz, 2020, Mutual fund performance and flows during the COVID-19 crisis, *Review of Asset Pricing Studies* 10, 791--833.

Ramelli, Stefano, and Alexander F. Wagner, 2020, Feverish Stock Price Reactions to COVID-19, *Review of Corporate Finance Studies* 9, 622--655.

Ru, Hong, Endong Yang, and Kunru Zou, 2020, What do we learn from SARS-CoV-1 to SARS-CoV-2: Evidence from global stock markets, Working Paper.

Schrimpf, Andreas, Hyun Song Shin, and Vladyslav Sushko, 2020, Leverage and margin spirals in fixed income markets during the COVID-19 crisis, Bank for International Settlements.

Shleifer, Andrei, 1986, Do demand curves for stocks slope down?, *The Journal of Finance* 41.

Shleifer, Andrei, and Robert Vishny, 2011, Fire sales in finance and macroeconomics, *Journal of Economic Perspectives* 25, 29--48.

Sias, Richard W, 2004, Institutional herding, *Review of Financial Studies* 17, 165--206.

Sias, Richard W, and Laura T Starks, 1997, Return autocorrelation and institutional investors, *Journal of Financial Economics* 46, 103--131.

Simutin, Mikhail, 2014, Cash holdings and mutual fund performance, *Review of Finance* 18, 1425--1464.

Stein, Jeremy C., 2009, Presidential address: Sophisticated investors and market efficiency, *Journal of Finance* 64, 1517--1548.

Takahashi, Hidenori, and Kazuo Yamada, 2021, When the Japanese stock market meets COVID-19: Impact of ownership, China and US exposure, and ESG channels, *International Review of Financial Analysis* 74, 101670.

Welch, Ivo, 2021, The Wisdom of the Robinhood crowd, *The Journal of Finance* forthcoming.

Figures

Figure 2: Relation between IO and revisions of EPS forecasts
Binned scatter plots of mean EPS forecast revisions at the 2021 horizon against the level of IO 2019-Q4. The plot controls for industry fixed effects and the baseline expected EPS.

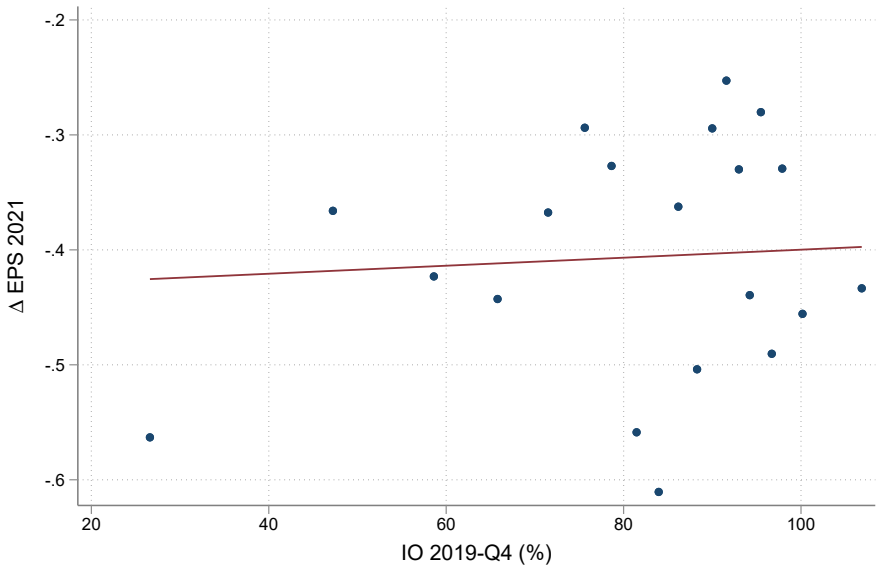


Figure 3: Change in institutional ownership and firm characteristics in 2020-Q1
Panel A shows the difference in the distribution of Δ *IO 2020Q1*, the stock-level changes in institutional ownership of Russell 3000 non-financial constituents between 2019-Q4 and 2020-Q1, compared to Δ *IO 2019Q4*, the equivalent changes between 2019-Q3 and 2019-Q4. Panel B shows binned scatter plots of the net change in institutional ownership in 2020-Q1 on firm leverage, cash holdings, and environmental and social (ES) scores. The plots control for firm size, profitability, book-to-market, stock illiquidity, as well as the level of IO at the end of the previous quarter.

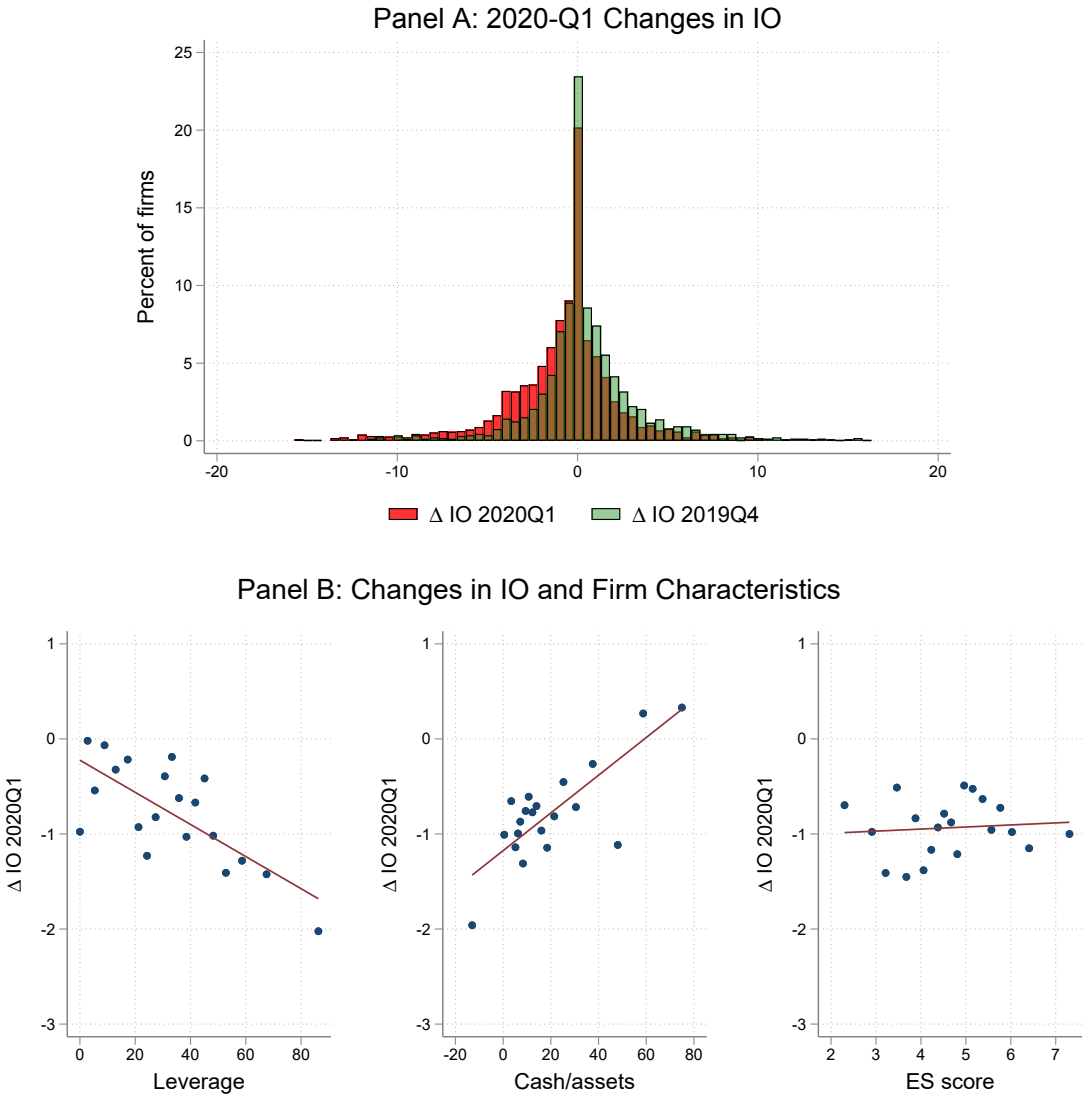


Figure 4: Change in retail investor popularity against the change in institutional ownership

Panel A shows a binned scatter plot of the percentage change in the popularity of a stock with retail investors (proxied by the log of Robinhood users between 2019-Q4 and 2020-Q1, *%Δ log(RHusers) 2020Q1*) against the change in institutional ownership over the same time period (Δ *IO 2020Q1*). Panel B plots Δ *IO 2020Q1* and *%Δ log(RHusers)* 2020Q1 by industry. The industries are sorted in ascending order by average cumulative returns in the *Fever* period, reported (rounded to integers) in parentheses next to the industry names.

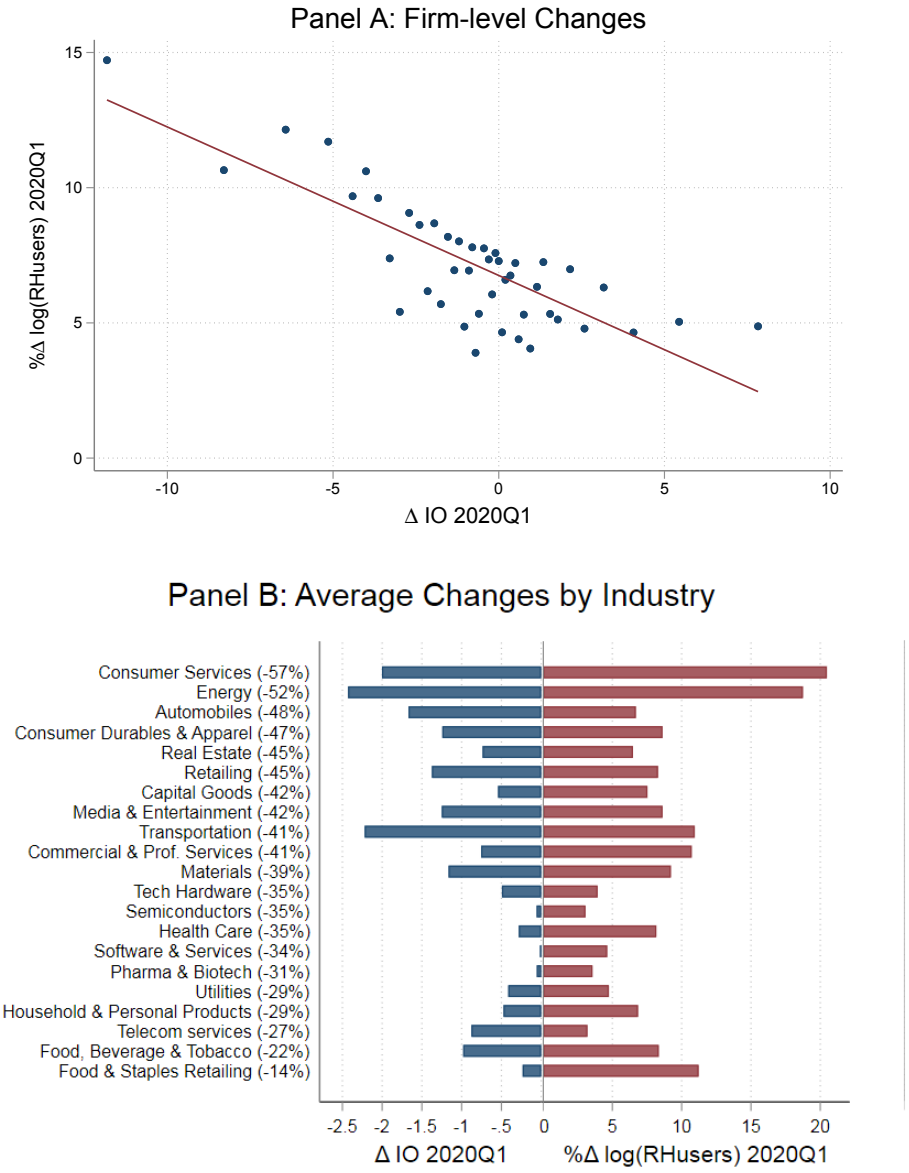


Figure 5: Retail investor interest and firm characteristics
These graphs show the day-to-day evolution of retail investor interest in cash, leverage, and ES performance. Each point is the coefficient on either Cash/assets, Leverage, or ES (msci) from OLS regressions of the percentage change in log Robinhood users between 2020-01-01 and the given date (shown on the x-axis). The explanatory variables in all regressions are Cash/assets, Leverage, log(RHusers$_{2019Q4}$), log(Market cap), Profitability, Book-to-market, and industry fixed effects. The raw data are missing from January 7, 2020 to January 15, 2020. The red vertical lines mark, respectively, the beginning of the *Fever* period (from February 24 through March 20), and the announcement of the Fed interventions (on March 23). The dashed lines indicate 90% confidence intervals based on robust standard errors.

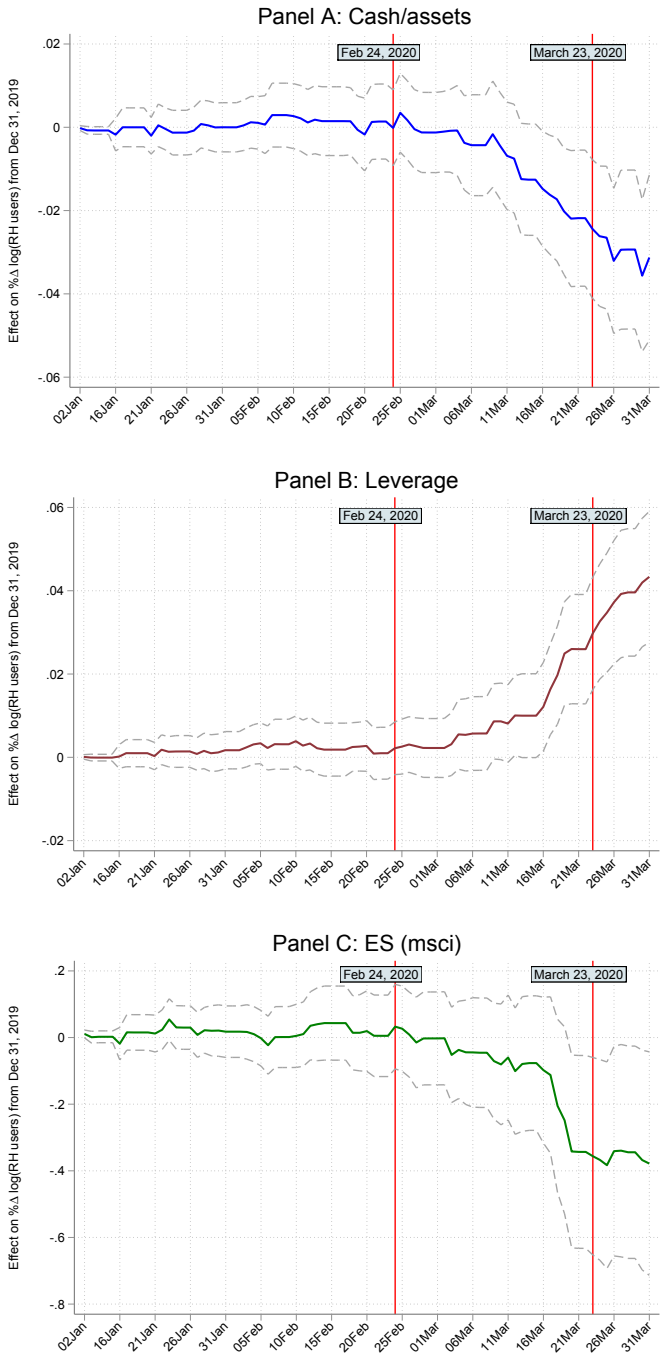


Figure 6: Net change in equity positions by investor category
These graphs show the net changes in equity positions between 2019-Q4 and 2020-Q1 due to active trading by institutional investor category. These changes are estimated based on the ownership by investor category of non-financial Russell 3000 constituents in 2019-Q4 and 2020-Q1, relative to firms' market capitalization on December 31, 2019. Panel A shows the change in million US$ and Panel B shows the changes in percentage of AUM as of 2019-Q4. *Hedge funds* include: hedge funds, funds of hedge funds, and private bank wealth. *Pension funds* include: pension funds and endowments. *Mutual funds* include: mutual funds and funds of mutual funds. *Investment advisors* include: investment advisors and brokers.

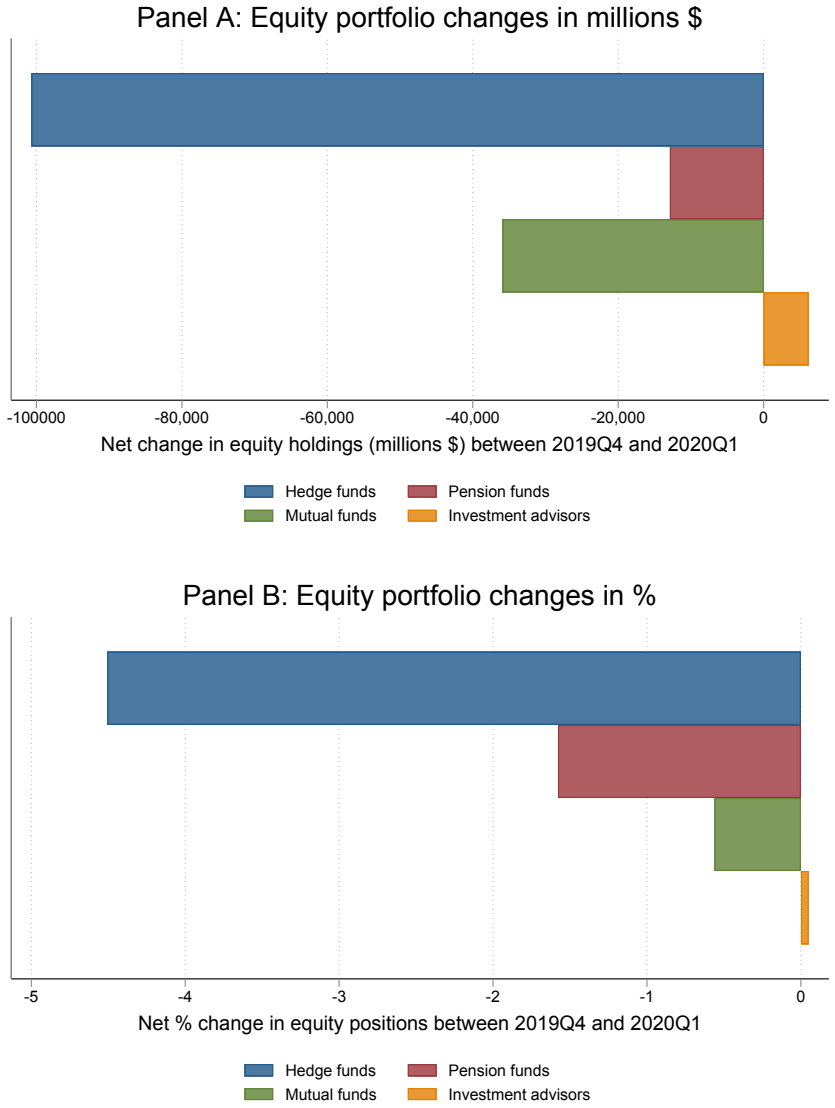
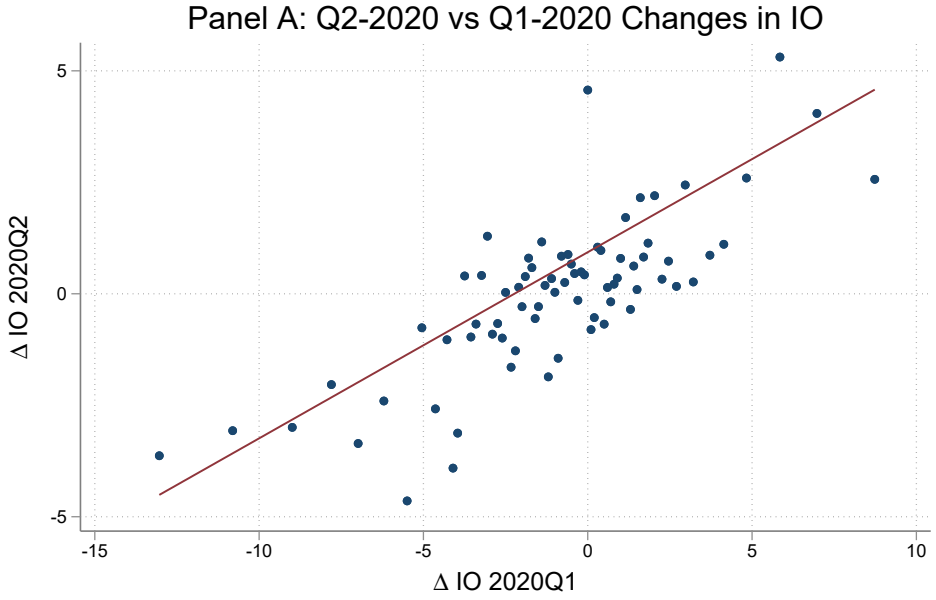
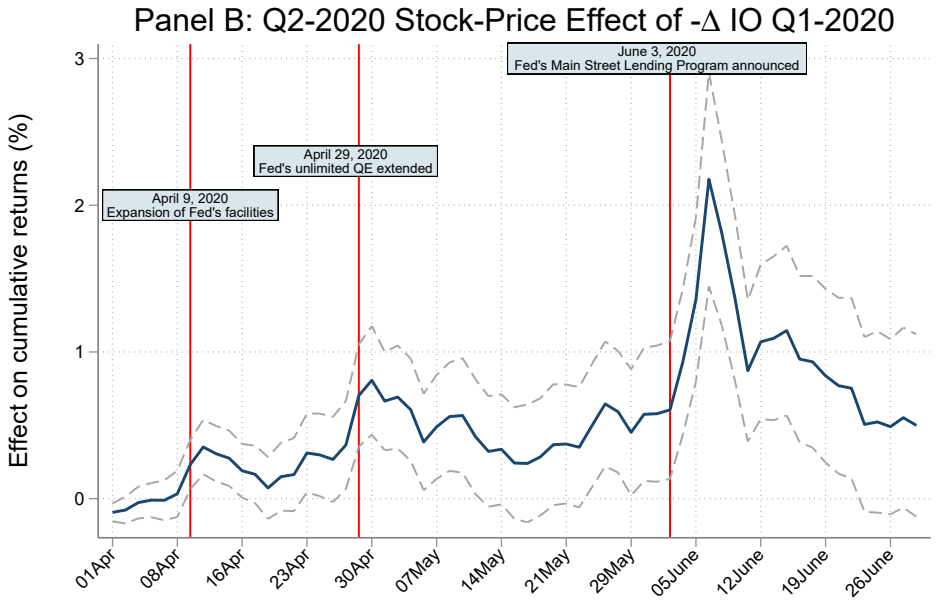


Figure 7: Stock returns during 2020-Q2 and correlation of changes in IO in 2020-Q2 vs 2020-Q1

Panel A shows a binned scatterplot of Δ *IO 2020Q2* against Δ *IO 2020Q1*. Panel B shows the evolution of the coefficients on the negative of Δ IO_{2020Q1} in regressions with the cumulative returns of Russell 3000 non-financial stocks from April 1, 2020 each day through June 30, 2020 as the dependent variable. The regressions control for firm characteristics (Cash/assets, Leverage, Market beta, Stock illiquidity, log(Market cap), Profitability, and Book-to-market) and industry fixed effects. The dashed lines indicate 90% confidence intervals based on robust standard errors. For ease of interpretation, we look at minus ΔIO_{2020Q1}.





Tables

Table 1: Sample statistics
This table shows descriptive statistics of the variables used in the analyses. The sample consists of non-financial constituents of Russell 3000. Appendix Table A1 provides a description of all variables.

	N	min	p25	mean	p50	p75	max	sd
Institutional and retail investor data								
IO_{2019Q4}	2,281	1.90	69.40	79.62	86.80	96.80	100.00	21.49
Δ IO 2020Q1	2,236	-15.70	-2.00	-0.79	-0.20	0.60	10.10	3.21
Δ IO 2020Q2	2,224	-30.60	-1.40	0.54	0.40	2.60	23.10	5.74
$PassiveIO_{2019Q4}$	2,281	0.78	15.48	21.26	21.60	27.54	61.60	8.37
$Long\text{-}termIO_{2019Q4}$	2,281	1.38	52.49	64.23	70.27	79.63	97.30	20.19
$ForeignIO_{2019Q4}$	2,281	0.02	3.78	10.57	7.05	12.30	100.00	14.55
LowFlowsInGFC IO_{2019Q4}	2,274	0.00	13.93	19.53	19.28	24.70	90.05	9.22
LowFlowsIn2020Q1 IO_{2019Q4}	2,268	0.00	6.39	10.65	9.38	13.51	83.69	6.79
HighLeverage IO_{2019Q4}	2,274	0.00	43.93	54.24	57.51	66.75	97.19	17.96
LowCash IO_{2019Q4}	2,274	0.00	12.65	22.00	21.64	30.00	100.00	13.35
IO Hedge $Funds_{2019Q4}$	2,281	0.05	6.29	13.59	10.30	17.78	75.35	10.38
Δ IO Hedge Funds 2020Q1	2,281	-22.67	-1.38	-0.12	-0.28	0.90	31.40	3.10
IO ex. Hedge $Funds_{2019Q4}$	2,281	1.51	51.15	64.88	70.86	82.21	97.96	22.10
Δ IO ex. Hedge Funds 2020Q1	2,281	-45.21	-2.06	-0.53	-0.10	1.52	54.77	4.56
$RHusers_{2019Q4}$	2,257	0.00	158.00	3,525.19	453.00	1,492	321,191	17,735.68
$\log(RHusers_{2019Q4})$	2,257	0.00	5.07	6.25	6.12	7.31	12.68	1.72
%Δ log(RHusers) 2020Q1	2,210	-5.20	1.49	7.24	4.37	9.45	53.39	9.20
%Δ log(RHusers) 2020Q2	2,216	-2.46	2.66	7.61	5.95	10.47	41.65	7.02
Stock returns, firm characteristics, and analysts' earnings forecast revisions								
Return in Fever	2,281	-88.03	-50.93	-39.16	-38.57	-27.72	209.57	19.67
Market beta	2,282	-0.87	0.82	1.15	1.13	1.47	3.56	0.50
Stock illiquidity	2,248	0.00	0.02	0.81	0.11	0.50	14.91	2.15
Leverage	2,269	0.00	14.68	33.08	32.57	46.77	100.00	22.66
Cash/assets	2,275	0.00	2.59	19.84	8.61	25.84	99.74	25.00
log(Market cap)	2,282	16.35	20.27	21.54	21.42	22.61	27.92	1.72
Profitability	2,275	-32.73	-1.03	-1.01	0.61	1.73	9.33	6.10
Book-to-market	2,274	-6.49	0.16	0.47	0.34	0.61	22.14	0.84
ES score (msci)	1,670	1.30	3.70	4.62	4.60	5.50	8.55	1.25
ΔEPS_{2020}	1,900	-16.52	-0.48	-0.48	-0.06	0.00	12.87	2.01
ΔEPS_{2021}	2,061	-16.91	-0.43	-0.41	-0.04	0.00	12.11	1.88
ΔEPS_{2022}	1,562	-17.11	-0.48	-0.44	-0.03	0.00	14.58	2.21

Table 2: Stock returns and institutional ownership

This table shows OLS regression results of stock-level returns in the *Fever* period (from February 24 through March 20, 2020), on measures of institutional ownership, Leverage, Cash holdings, ES score, and other controls (Market beta, log(Market cap), Profitability, Book-to-market, and stock illiquidity). We show the stock price effect of institutional ownership and also its heterogeneity by investor category. All models also control for GICS industry group fixed effect indicators. t-statistics based on robust standard errors are presented in parentheses. ***, **, and * indicate that the coefficient estimate is significantly different from zero at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)	(4)	(5)
	Dependent variable: Return in Fever (Feb24-Mar20, 2020)				
IO_{2019Q4}	-0.069***	-0.056**	-0.104***	-0.249***	-0.076***
	(-2.92)	(-1.97)	(-3.68)	(-4.68)	(-3.22)
$PassiveIO_{2019Q4}$			0.169**		
			(2.55)		
$Long\text{-}termIO_{2019Q4}$				0.228***	
				(4.15)	
$ForeignIO_{2019Q4}$					0.083***
					(2.82)
Leverage	-0.105***	-0.135***	-0.100***	-0.094***	-0.108***
	(-4.67)	(-5.47)	(-4.43)	(-4.17)	(-4.84)
Cash/assets	0.086***	0.146***	0.095***	0.108***	0.087***
	(3.55)	(5.11)	(3.90)	(4.43)	(3.60)
ES score (msci)		0.801**			
		(2.18)			
Market beta	-6.505***	-8.368***	-6.531***	-6.549***	-6.459***
	(-6.06)	(-6.57)	(-6.09)	(-6.13)	(-6.02)
Stock illiquidity	0.665***	0.448	0.753***	0.651***	0.659***
	(2.80)	(0.91)	(3.15)	(2.78)	(2.77)
log(Market cap)	1.313***	0.933***	1.321***	0.918***	1.135***
	(4.55)	(3.06)	(4.58)	(2.88)	(3.74)
Profitability	0.193*	0.355**	0.188*	0.196*	0.197*
	(1.72)	(2.23)	(1.68)	(1.76)	(1.76)
Book-to-market	0.364	0.460	0.374	0.574	0.248
	(0.44)	(0.44)	(0.45)	(0.69)	(0.29)
Constant	-35.131***	-34.235***	-36.351***	-33.214***	-33.914***
	(-9.10)	(-7.56)	(-9.41)	(-8.37)	(-8.61)
Observations	2,234	1,649	2,234	2,234	2,234
R-squared	0.233	0.318	0.235	0.241	0.237
Industry FE	Yes	Yes	Yes	Yes	Yes

Table 3: Evidence on institutional fire sales

This table shows OLS regression results of stock-level returns in the *Fever* period on measures of institutional ownership, institutional ownership portfolio characteristics, and controls variables (Leverage, Cash holdings, Market beta, log(Market cap), Profitability, Book-to-market, and stock illiquidity). Panel A shows the effects of institutional investors' portfolio characteristics. Panel B controls for revisions in analysts' earning forecasts. All models also control for GICS industry group fixed effect indicators. t-statistics based on robust standard errors are presented in parentheses. ***, **, and * indicate that the coefficient estimate is significantly different from zero at the 1%, 5%, and 10% level, respectively.

Panel A: Interactions with institutional portfolio characteristics

	(1)	(2)	(3)	(4)	(5)	(6)
	Dependent variable: Return in Fever (Feb24-Mar20, 2020)					
IO_{2019Q4}	-0.049**	-0.041	-0.045	-0.057**	-0.063**	-0.076***
	(-2.11)	(-1.64)	(-1.60)	(-2.01)	(-2.58)	(-3.06)
LowFlowsInGFC IO_{2019Q4}	-0.184***					
	(-3.09)					
LowFlowsIn2020Q1 IO_{2019Q4}		-0.195***				
		(-2.98)				
HighLeverage IO_{2019Q4}			-0.045	0.109**		
			(-1.42)	(2.07)		
HighLeverage IO_{2019Q4} × Leverage				-0.004***		
				(-3.15)		
LowCash IO_{2019Q4}					-0.029	-0.096**
					(-0.79)	(-2.30)
LowCash IO_{2019Q4} × Cash/assets						0.009***
						(4.14)
Leverage	-0.099***	-0.101***	-0.098***	0.110	-0.103***	-0.101***
	(-4.39)	(-4.53)	(-4.21)	(1.43)	(-4.56)	(-4.46)
Cash/assets	0.091***	0.088***	0.082***	0.096***	0.081***	-0.010
	(3.76)	(3.66)	(3.35)	(3.93)	(3.23)	(-0.28)
Observations	2,227	2,221	2,227	2,227	2,227	2,227
R-squared	0.236	0.235	0.233	0.240	0.233	0.239

Panel B: Controlling for changes in earnings expectations

	(1)	(2)	(3)	(4)
	Dependent variable: Return in Fever (Feb24-Mar20, 2020)			
IO_{2019Q4}	-0.055**	-0.054**	-0.064**	-0.073**
	(-2.31)	(-2.32)	(-2.21)	(-2.39)
ΔEPS_{2020}	0.843***			0.023
	(3.31)			(0.04)
ΔEPS_{2021}		1.225***		1.102*
		(4.42)		(1.87)
ΔEPS_{2022}			0.975***	0.394
			(3.22)	(0.92)
Leverage	-0.122***	-0.122***	-0.090***	-0.093***
	(-5.23)	(-5.46)	(-3.44)	(-3.29)
Cash/assets	0.041	0.066**	0.069**	0.033
	(1.48)	(2.48)	(2.33)	(1.02)
Observations	1,879	2,031	1,536	1,336
R-squared	0.244	0.266	0.263	0.249
Controls	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes

Table 4: Determinants of changes in institutional ownership
This table shows OLS regression results of the change in institutional ownership between 2019-Q4 and 2020-Q1 on firm characteristics. The dependent variable is the change in the percentage of institutional ownership (Δ *IO 2020Q1*). The sample consists of non-financial Russell 3000 constituents. t-statistics based on robust standard errors are presented in parentheses. ***, **, and * indicate that the coefficient estimate is significantly different from zero at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)	(4)	(5)
Dependent variable:			Δ *IO 2020Q1*		
Return in Fever	0.032***	0.025***			
	(5.83)	(4.51)			
Leverage			-0.010**	-0.009**	-0.005
			(-2.46)	(-2.37)	(-1.17)
Cash/assets			0.009**	0.007*	0.007
			(2.12)	(1.69)	(1.34)
log(Market cap)			0.191***	0.246***	0.254***
			(4.62)	(5.67)	(4.92)
Profitability			0.027*	0.035**	0.025
			(1.68)	(2.17)	(1.20)
Book-to-market			-0.172	-0.143	-0.128
			(-1.46)	(-1.21)	(-0.99)
IO_{2019Q4}				-0.017***	-0.008*
				(-5.65)	(-1.89)
ES score (msci)					-0.062
					(-0.97)
Constant	0.451**	0.195	-2.031***	-1.066**	-1.898***
	(2.08)	(0.88)	(-5.12)	(-2.56)	(-3.01)
Observations	2,235	2,235	2,223	2,223	1,637
R-squared	0.036	0.067	0.070	0.081	0.069
Industry FE	No	Yes	Yes	Yes	Yes

Table 5: Changes in ownership by investor category and firm characteristics

The table shows OLS regression results of the change in ownership by investor category between 2019-Q4 and 2020-Q1 on firm characteristics. The sample consists of non-financial Russell 3000 constituents. t-statistics based on robust standard errors are presented in parentheses. ***, **, and * indicate that the coefficient estimate is significantly different from zero at the 1%, 5%, and 10% level, respectively.

Dep. variable:	Δ IO Hedge Funds 2020Q1			Δ IO ex. Hedge Funds 2020Q1			% Δ $log(RHusers)$ 2020Q1		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Return in Fever	-0.009**			0.033***			-0.117***		
	(-2.53)			(6.35)			(-5.32)		
Leverage		-0.002	0.003		-0.010**	-0.012**		0.041***	0.047***
		(-0.64)	(0.75)		(-2.42)	(-2.38)		(4.35)	(4.02)
Cash/assets		-0.003	-0.002		0.006	0.008		-0.033***	-0.047***
		(-0.72)	(-0.46)		(1.25)	(1.41)		(-2.79)	(-2.92)
IO Hedge Funds_{2019Q4}		-0.021***	-0.023***						
		(-3.24)	(-2.58)						
IO ex. Hedge Funds_{2019Q4}					-0.028***	-0.018***			
					(-7.69)	(-3.82)			
$log(RHusers_{2019Q4})$								-1.567***	-1.491***
								(-12.94)	(-10.17)
ES score (msci)			-0.056			0.042			-0.376*
			(-0.99)			(0.53)			(-1.86)
log(Market cap)		-0.064**	-0.040		0.290***	0.235***		0.623***	0.524***
		(-2.06)	(-1.05)		(6.21)	(4.37)		(5.71)	(3.47)
Profitability		-0.026**	-0.036**		0.060***	0.069***		-0.145***	-0.141**
		(-2.03)	(-2.18)		(3.80)	(2.90)		(-4.18)	(-2.53)
Book-to-market		-0.181*	-0.091		-0.027	-0.098		0.635***	0.545*
		(-1.73)	(-0.82)		(-0.21)	(-0.82)		(2.64)	(1.95)
Constant	-0.502***	0.816**	0.665	0.814***	-0.603	-1.101*	2.686***	11.122***	13.334***
	(-3.74)	(2.51)	(1.54)	(3.98)	(-1.41)	(-1.77)	(3.03)	(11.05)	(9.46)
Observations	2,236	2,224	1,632	2,236	2,223	1,641	2,209	2,196	1,622
R-squared	0.023	0.032	0.035	0.078	0.088	0.086	0.203	0.231	0.239
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes			

Table 6: Determinants of changes in institutional ownership in 2020-Q2
This table shows OLS regression results of the change in institutional ownership between 2020-Q1 and 2020-Q2 (Δ *IO 2020Q2*) on firm characteristics. The sample consists of non-financial Russell 3000 constituents. t-statistics based on robust standard errors are presented in parentheses. ***, **, and * indicate that the coefficient estimate is significantly different from zero at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)	(4)	(5)
Dependent variable:			Δ *IO 2020Q2*		
Return in Fever	0.071***	0.060***			
	(9.41)	(8.08)			
Leverage			-0.021***	-0.022***	-0.013
			(-3.02)	(-3.08)	(-1.62)
Cash/assets			0.027***	0.029***	0.023**
			(3.30)	(3.60)	(2.48)
IO_{2020Q1}				0.026***	0.046***
				(4.19)	(5.70)
ES score (msci)					0.098
					(0.81)
log(Market cap)			0.263***	0.175**	-0.018
			(3.32)	(2.18)	(-0.19)
Profitability			0.008	-0.004	0.017
			(0.26)	(-0.14)	(0.41)
Book-to-market			-1.070***	-1.118***	-0.619
			(-2.60)	(-2.71)	(-1.40)
Constant	3.328***	2.908***	-0.840	-2.207**	-3.320***
	(11.63)	(10.04)	(-0.99)	(-2.42)	(-2.70)
Observations	2,223	2,223	2,210	2,210	1,622
R-squared	0.057	0.120	0.120	0.127	0.107
Industry FE	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes

Appendix

Table A1: Variable definitions

Institutional and retail investor ownership data Sources: FactSet and Robinhood	
IO_{2019Q4}	is the percentage of common stocks held by institutional investors (that file 13-F forms) as of 2019-Q4, truncated at 100.
Δ *IO 2020Q1*	is the change between 2019-Q4 and 2020-Q1 in the percentage of common stocks held by institutional investors, trimmed at the 1st and 99th percentiles.
Δ *IO 2020Q2*	is the change between 2020-Q1 and 2020-Q2 in the percentage of common stocks held by institutional investors, trimmed at the 1st and 99th percentiles.
$PassiveIO_{2019Q4}$	is the percentage of common stocks held by passive institutional investors.
$Long\text{-}termIO_{2019Q4}$	is the percentage of common stocks held by institutional investors classified as having a ''very low'' or ''low'' turnover as of 2019-Q4.
$ForeignIO_{2019Q4}$	is the percentage of common stocks held by non-domestic institutional investors as of 2019-Q4.
LowFlowsIn2020Q1 IO_{2019Q4}	is the percentage of common stocks held by institutional investors that experienced flows in the bottom tercile during the first quarter of 2020 (between December 2019 and March 2021).
LowFlowsInGFC IO_{2019Q4}	is the percentage of common stocks held by institutional investors that flows in the bottom tercile during the Global Financial Crisis (between December 2007 and June 2009).
HighLeverage IO_{2019Q4}	is the percentage of common stocks held by institutional investors with above-median value-weighted exposure to *Leverage* as of 2019-Q4.
LowCash IO_{2019Q4}	is the percentage of common stocks held by institutional investors with below-median value-weighted exposure to *Cash/assets* as of 2019-Q4.
IO HedgeFunds$_{2019Q4}$	is the percentage of common stocks held by hedge funds, funds of hedge funds, and private bank wealth managers as of 2019-Q4.
Δ *IO HedgeFunds 2020Q1*	is the change between 2019-Q4 and 2020-Q1 in the percentage of common stocks held by institutional investors classified as hedge funds, trimmed at the 1st and 99th percentiles.
IO ex.HedgeFunds$_{2019Q4}$	is the percentage of common stocks held by institutional investors as of 2019-Q4 not classified as hedge funds. .
Δ *IO ex.HedgeFunds 2020Q1*	is the change between 2019-Q4 and 2020-Q1 in the percentage of common stocks held by institutional investors not classified as hedge funds, trimmed at the 1st and 99th percentiles.
log(RHusers$_{2019Q4}$*)*	is the natural logarithm of the Robinhood users (plus one) holding a firm's stock as of December 31, 2019.
%Δ *log(RHusers) 2020Q1*	is the percentage change in log Robinhood users (plus one) between December 31, 2019 and March 31, 2020.
%Δ *log(RHusers) 2020Q2*	is the percentage change in log Robinhood users (plus one) between March 31, 2020 and June 30, 2020.

Stock returns, accounting data, and analysts' earnings forecast revisions
Sources: Compustat Capital IQ North America and IBES

Return in Fever	is computed by compounding daily returns (adjusted for stock splits and dividends) from February 24 through March 20, 2020 (the *Fever* period).
Market beta	is computed based on regressions of daily excess returns in 2019 on a constant and the daily market factor. The market excess return and the return on the riskless asset (the U.S. 1-month Treasury-bill rate) are from Kenneth French's website.
Stock illiquidity	is the Amihud (2002) measure of stock illiquidity. It is computed as the ratio of absolute daily returns to daily volumes in USD millions, averaged over all trading days of 2019. The measure is winsorized at the 1st and 99th percentiles to control for outliers.
Leverage	is the percentage of long-term debt plus debt in current liabilities over total assets ((dltt + dlc)*100/at) as of 2019-Q4, truncated at 100%.
Cash/assets	is cash and cash equivalents over total assets (che*100/at) as of 2019-Q4, in percentage points.
log(Market cap)	is the logarithm of the equity market capitalization as of December 31, 2019.
Book-to-market	is the book value of equity divided by market valuation as of December 31, 2019.
Profitability	is the return on assets (in percentage) computed as the quarterly income before extraordinary items over total assets as of 2019-Q4.
ΔEPS_t	is the change between February 20, 2020, and March 19, 2020, in the mean EPS forecast (normalized by the stock price on December 31, 2019, and multiplied by 100) at horizon t, trimmed at the 1st and 99th percentiles. For each firm, we focus on three horizons: 2020 (accounting year ending in Q2-2020), 2021, and 2022.

Environmental and social performance
Source: MSCI IVA

ES score (msci)	is the average of the 2018 environmental and social scores from the MSCI IVA database.

Online Appendix

Figure OA1: Stock returns and institutional ownership -- International sample
This graph shows the evolution of the coefficients on *Institutional Ownership* in regressions with the cumulative returns from January 2, 2020 each day through March 31, 2020 as the dependent variable. The international sample consists of 1,159 non-financial and non-US stocks firms included in the MSCI ACWI index and located in 48 emerging and developed markets countries. The regressions control for GICS industry group indicators and firm characteristics (Market beta, log(Market cap), Profitability, and Book-to-market). *Institutional Ownership* is the percentage of shares owned by institutional shareholders at the end of the fourth quarter 2019. The red vertical lines mark, respectively, the beginning of the Fever period (from February 24 through March 20), and the announcement of the Fed interventions (on March 23, 2020). The dashed lines indicate 90% confidence intervals based on robust standard errors.

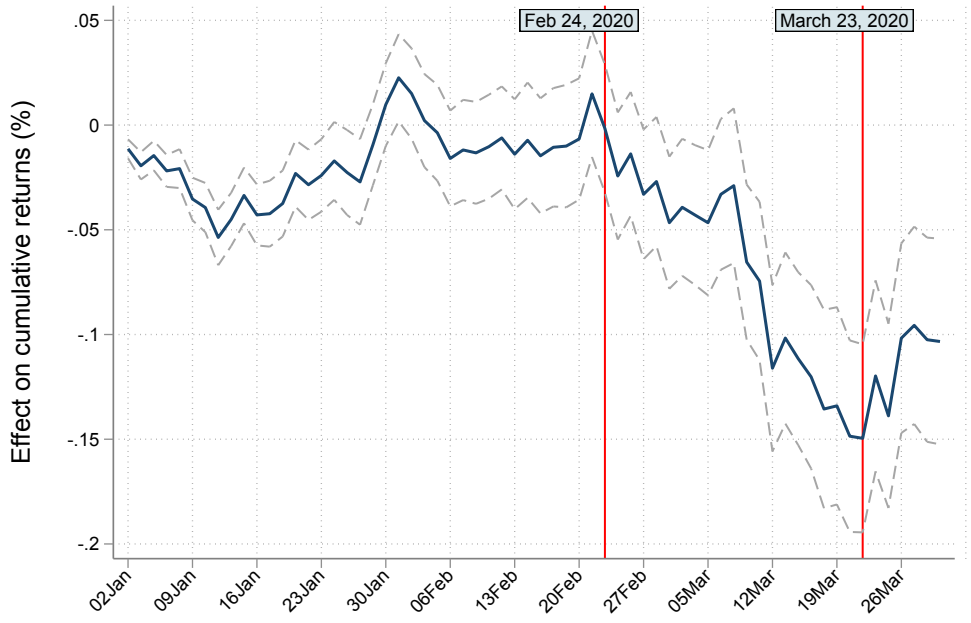


Figure OA2: Quarterly changes in institutional ownership during 2019
These graphs show the distribution of quarter-to-quarter changes in institutional ownership in 2019.

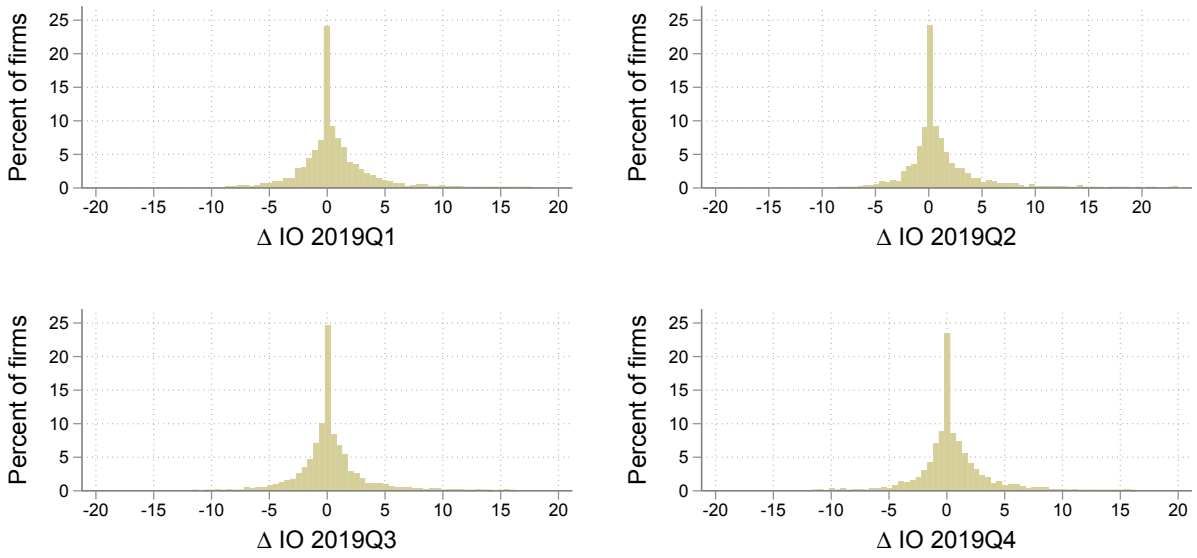


Figure OA3: Changes in IO: S&P500 firms and passive ownership
Panel A compares changes in institutional ownership between 2019-Q4 and 2020-Q1 of non-financial S&P500 firms vs. non-financial Russell 3000 firms not included in the S&P500 index. Panel B compares changes in overall institutional ownership in 2020-Q1 (Δ *IO 2020Q1*) with the distribution of changes in passive institutional ownership.

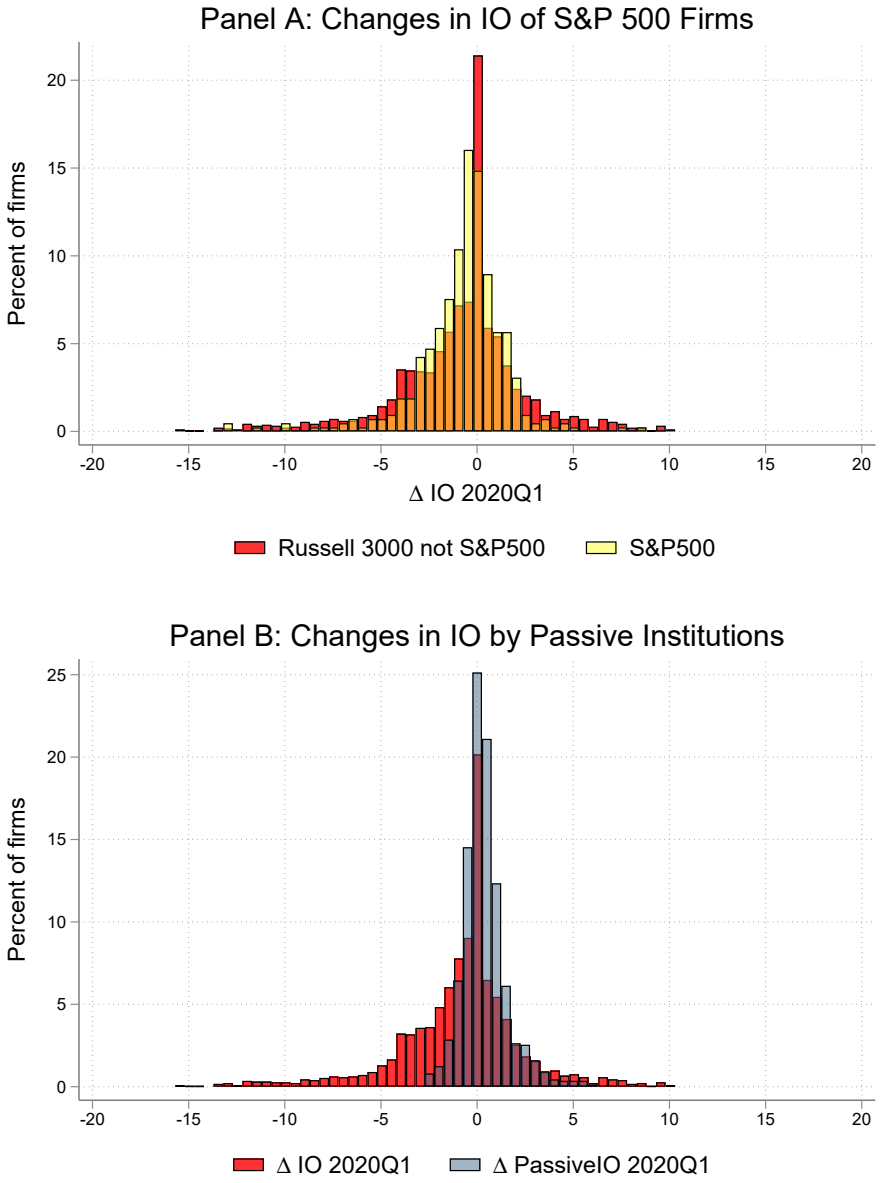


Figure OA4: Changes in IO: 2020-Q2 vs 2020-Q1
The graph shows the distribution of Δ *IO 2020Q2* compared to the distribution of Δ *IO 2020Q1*.

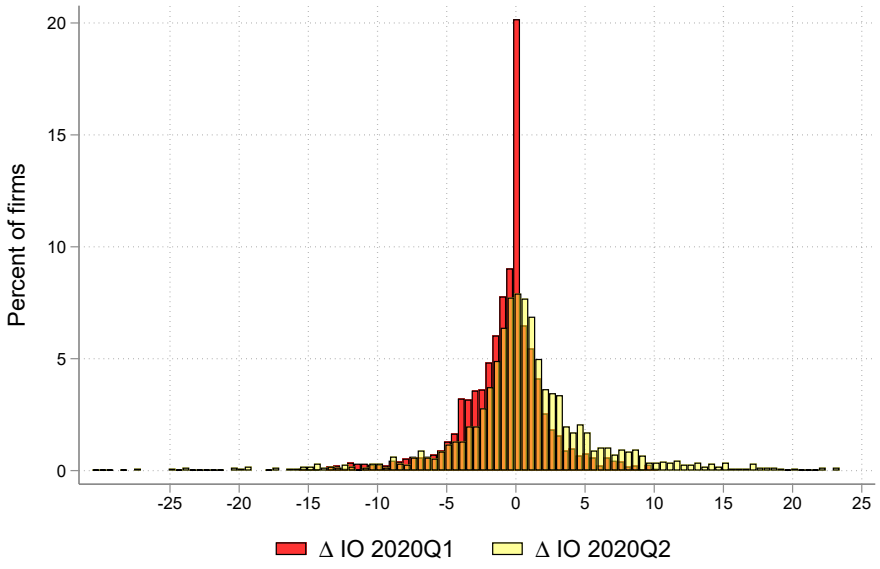


Figure OA5: Change in retail investor popularity against change in institutional ownership during 2020-Q2

Panel A shows a binned scatter plot of the percentage change in the popularity of a stock with Robinhood users between 2020-Q1 and 2020-Q2, (*%Δ log(RHusers) 2020Q2*) against the change in institutional ownership over the same period (*Δ IO 2020Q2*). Panel B plots *Δ IO 2020Q2* and *%Δ log(RHusers) 2020Q2* by industry group. The industries are sorted in ascending order by average cumulative returns in the Fever period, reported (rounded to integers) in parentheses next to the industry names.

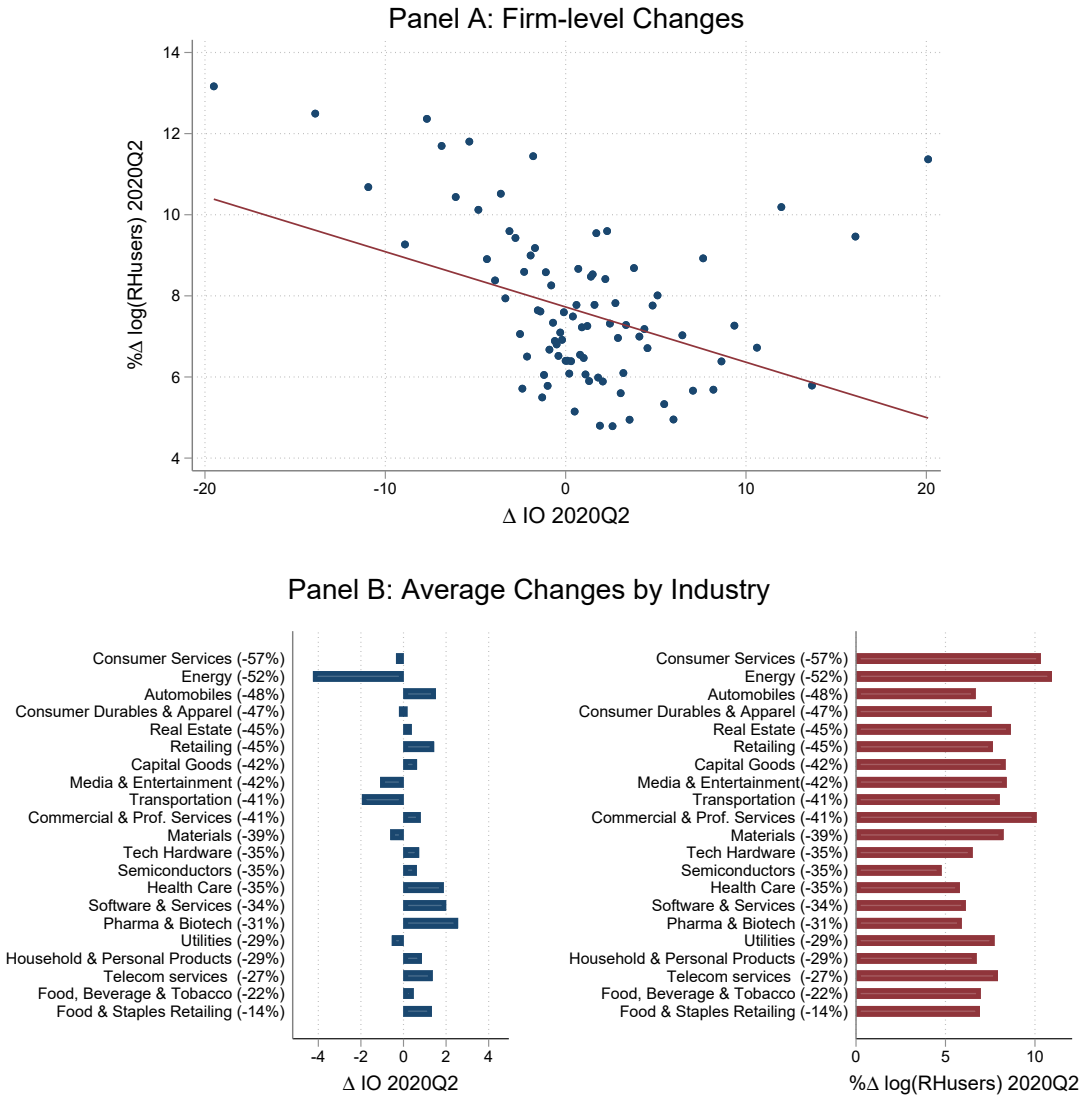


Figure OA6: Change in IO in 2020-Q2 and firm characteristics
Binned scatter plots of the net change in institutional ownership in 2020-Q2 on firm leverage, cash holdings, and environmental and social (ES) scores. The plots control for firm size, profitability, book-to-market, stock illiquidity, as well as the level of IO at the end of the previous quarter.

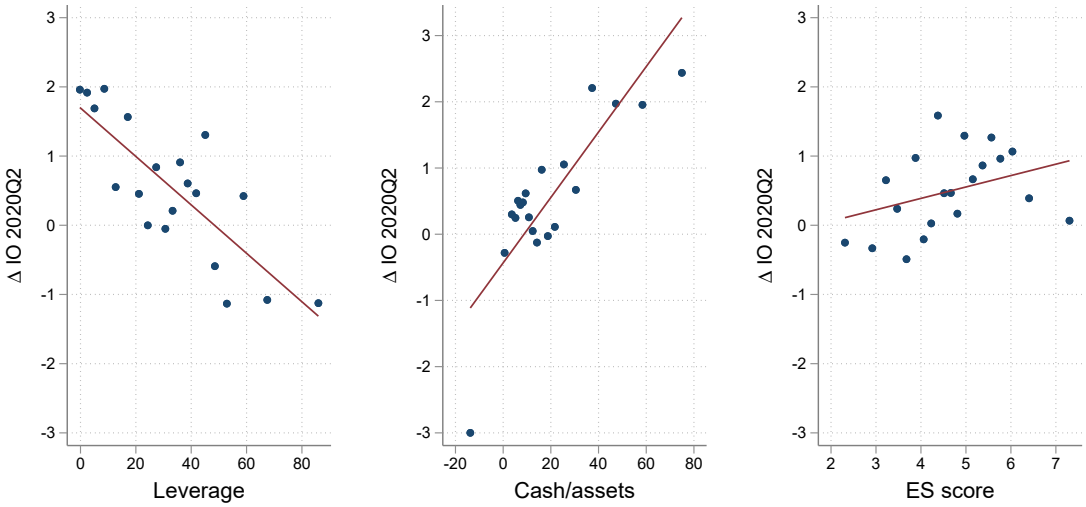


Figure OA7: Evolution of retail investor interest and firm characteristics during 2020-Q2

These graphs show the day-to-day evolution of retail investor interest in cash, leverage, and ES performance over the second quarter of 2020. Each point is the coefficient on either Cash/assets, Leverage, or ES (msci) from OLS regressions of the percentage change in log Robinhood users between April 1, 2020 and the given date (shown on the x-axis). The explanatory variables in all regressions are Cash/assets, Leverage, log(RHusers$_{2020Q1}$), log(Market cap), Profitability, Book-to-market, and industry fixed effects. The dashed lines indicate 90% confidence intervals based on robust standard errors.

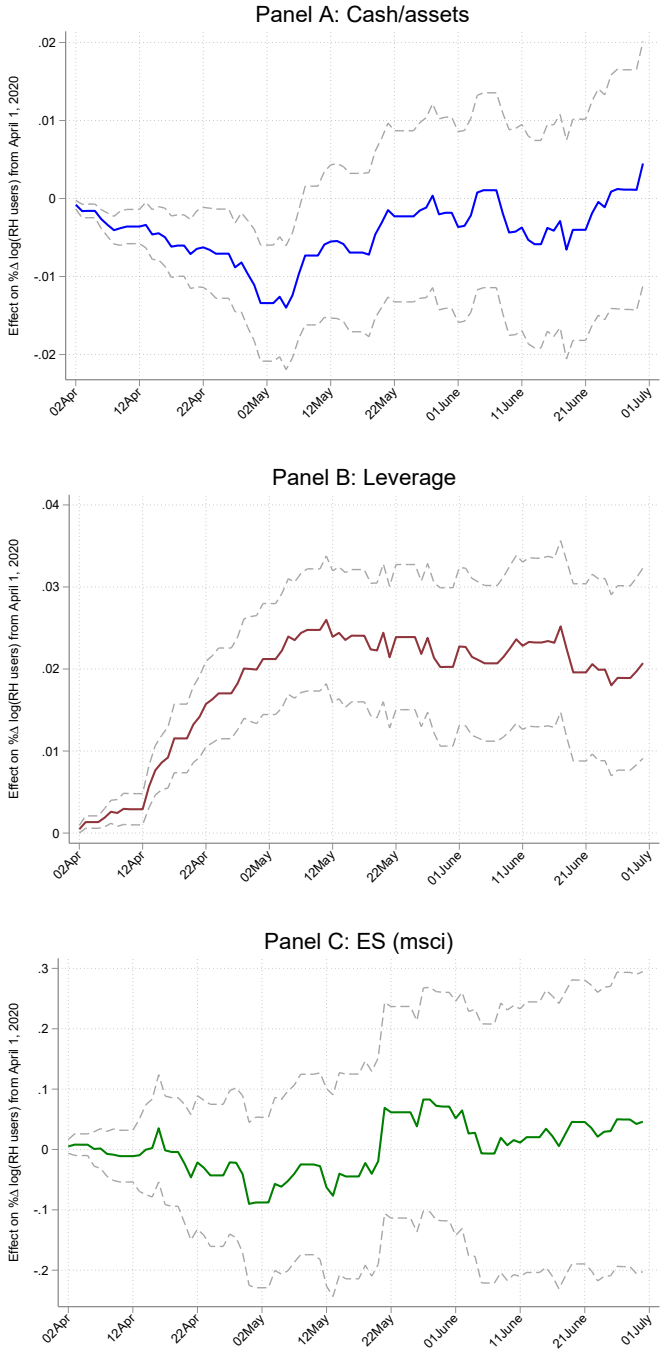


Table OA1: Determinants of changes in institutional ownership: Placebo tests
This table shows OLS regression results of the change in institutional ownership between 2019-Q4 and 2020-Q1 on firm characteristics. Panel A shows the change in institutional ownership for non-financial S&P 500 firms and Panel B show the change in passive ownership for non-financial Russell 3000 firms. t-statistics based on robust standard errors are presented in parentheses. ***, **, and * indicate that the coefficient estimate is significantly different from zero at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)	(4)	(5)
Panel A:Δ *IO 2020Q1* for S&P 500					
Return in Fever	0.028***	0.034***			
	(2.86)	(2.90)			
Leverage			-0.002	-0.002	-0.001
			(-0.29)	(-0.21)	(-0.17)
Cash/assets			0.005	0.005	0.007
			(0.54)	(0.51)	(0.73)
IO_{2019Q4}				-0.019	-0.019
				(-1.59)	(-1.59)
ES score (msci)					-0.005
					(-0.06)
Observations	424	424	421	421	399
R-squared	0.034	0.134	0.111	0.118	0.106
Firm controls	No	No	Yes	Yes	Yes
Industry FE	No	Yes	Yes	Yes	Yes
Panel B: Dependent variable: Δ *PassiveIO 2020Q1*					
Return in Fever	-0.010***	-0.005***			
	(-4.91)	(-2.92)			
Leverage			0.002	0.002	0.003
			(1.44)	(1.55)	(1.49)
Cash/assets			-0.002	-0.002	-0.003
			(-1.56)	(-1.09)	(-1.56)
$PassiveIO_{2019Q4}$				0.009**	0.003
				(2.49)	(0.78)
ES score (msci)					0.031
					(1.24)
Observations	2,235	2,235	2,222	2,222	1,625
R-squared	0.026	0.099	0.113	0.116	0.136
Firm controls	No	No	Yes	Yes	Yes
Industry FE	No	Yes	Yes	Yes	Yes

european corporate governance institute

about ECGI

The European Corporate Governance Institute has been established to improve *corporate governance through fostering independent scientific research and related activities.*

The ECGI will produce and disseminate high quality research while remaining close to the concerns and interests of corporate, financial and public policy makers. It will draw on the expertise of scholars from numerous countries and bring together a critical mass of expertise and interest to bear on this important subject.

ECGI Working Paper Series in Finance

www.ecgi.global/content/working-papers

Electronic Access to the Working Paper Series

The full set of ECGI working papers can be accessed through the Institute's Web-site (www.ecgi.global/content/working-papers) or SSRN:

Finance Paper Series	http://www.ssrn.com/link/ECGI-Fin.html
Law Paper Series	http://www.ssrn.com/link/ECGI-Law.html