Where Do Institutional Investors Seek Shelter when Disaster Strikes? Evidence from COVID-19

Finance Working Paper N° 688/2020
November 2020

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ECGI Working Paper Series in Finance

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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 Marie Brière, Jim Naughton, Raman Uppal, Arthur Romec, Johan Sulaeman, Kazuo Yamada, and Richard J. Zeckhauser, and seminar participants at the 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.

Abstract

During the COVID-19 market crash, U.S. stocks with higher institutional ownership -- in particular, those held more by active, short-term, and more exposed institutions -- performed worse. 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. The effects did not reverse in the second quarter. 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, Institutional ownership, Leverage, Pandemic, Retail investors, Robinhood, Tail risk

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

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RESEARCH

Swiss Finance Institute Research Paper Series N°20-56

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Evidence from COVID-19*

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November 1, 2020

Abstract

During the COVID-19 market crash, U.S. stocks with higher institutional ownership -- in particular, those held more by active, short-term, and more exposed institutions -- performed worse. 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. The effects did not reverse in the second quarter. 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.

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1 Introduction

Institutional investors play a crucial role in stock markets with institutional ownership (IO) accounting for 75% of U.S. stocks (up from below 40% in 1980). IO has been associated with more informative stock prices (Bai et al., 2016) and positive corporate governance effects (e.g., Dasgupta et al., 2020). However, Stein (2009) points out that in periods of crises institutions could enter the same trades and deleverage at the same time, creating a fire-sales externality that exacerbates a stock market crash.[1] Understanding the effects of institutional ownership is important not only for individual firms but also for financial stability.

This paper uses the novel coronavirus (COVID-19) pandemic as an exogenous shock to study how institutional investors react to a tail risk event. In the first quarter of 2020, firms suddenly faced major economic disruptions that caused an historic price correction in stock markets. We find that U.S. stocks with higher IO collapsed more in this crash. This relation was driven by an active retreat of institutional investors, which derisked their portfolios by ''fire-selling'' and rebalancing towards financially more resilient companies. Individual investors took the contrarian position.

The COVID-19 pandemic offers an ideal setting to study the behavior of institutional investors. The 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.

[1]The deleveraging by hedge funds in particular came under scrutiny in the Global Financial Crisis (Ben-David et al., 2012).

This is in contrast to, for example, the Global Financial Crisis (GFC hereafter), which arose from frictions in financial markets that developed over time, giving institutional investors plenty of time to reposition their portfolios.

Against this background, this paper provides insights on the following questions: First, did IO amplify or mitigate the COVID-19 stock crash and how did this vary across types of firms and institutions? Second, did institutions sell stocks indiscriminately or did they rebalance their equity portfolios in a ''flight-to-quality'', favoring stocks that were perceived to be more resilient? In the COVID-19 crash, companies fared better if they had strong corporate financials (Ramelli and Wagner, 2020; Fahlenbrach et al., 2020) or strong environmental and social (ES) performances (Albuquerque et al., 2020; Garel and Petit-Romec, 2020).[2] Which of these firm resiliency characteristics -- the ''hard'' or the ''soft'' -- did institutional investors perceive as signaling ''quality'' when facing a tail risk? Third, did retail investor interest for individual stocks mirror IO changes?

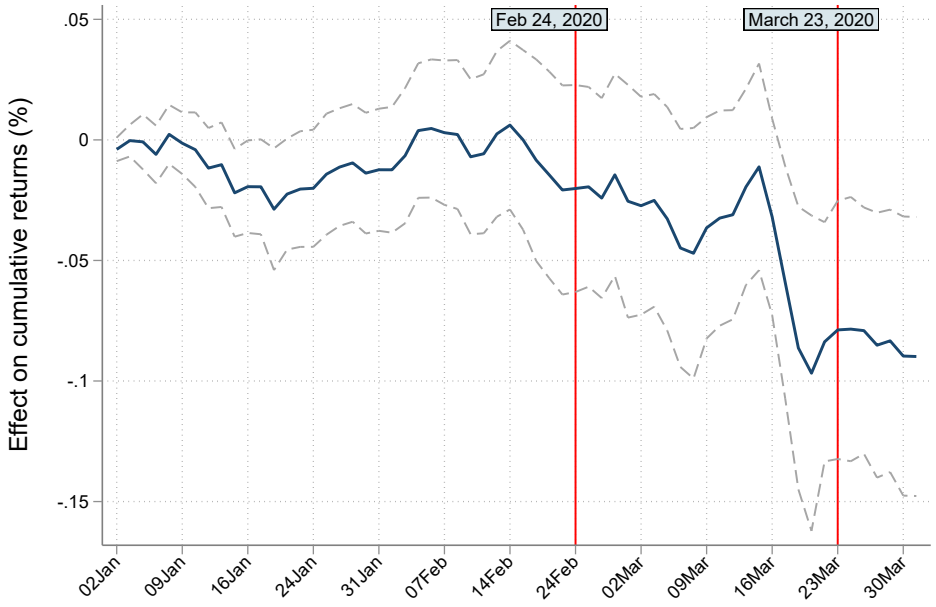
Our starting point is the result of Figure 1, which shows that for U.S. non-financial Russell 3000 firms the stock price performance during the *Fever* period (Ramelli and Wagner, 2020) -- from February 24 through March 20, 2020[3] -- is negatively related to the firm's end-of-2019 IO ratio, while controlling for the effects of cash, leverage, ES performance, stock illiquidity, and other firm and industry characteristics.[4]

[2]The latter result has been the subject of some debate (Demers et al., 2020; Mahmoud and Meyer, 2020). For mutual funds, Pástor and Vorsatz (2020) find that funds with higher sustainability ratings continued to attract higher inflows. However, Döettling and Kim (2020) find in a differences-in-differences setting that high-sustainability funds experienced sharper reductions in flows compared to the pre-crisis period.

[3]On Sunday February 23, Italy initiated the first major intervention and the World Health Organization characterized COVID-19 as a pandemic on March 11. A current situation overview can be found here: `https://ourworldindata.org/coronavirus`.

[4]This result also holds for international stocks. See Online Appendix Figure OA1.

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.



Our first set of results comes from examining this association in more detail, exploring several dimensions of investor heterogeneity. First, firms with low cash and high leverage experienced greater declines when they were held by institutional investors with portfolios heavily exposed to other stocks of firms with weak corporate financials. Thus, low cash and high leverage were not unconditionally signs of low resilience, but their value-relevance depended on the shareholders' exposure to financial risks. These results are consistent with "fire sales" externalities stemming from portfolio-level deleveraging and the search by institutions for more financially resilient firms. Second, also consistent with fire-selling, firms

held by institutional investors that had high outflows in the GFC of 2007/08 experienced more negative stock price reactions to COVID-19. Third, stocks held more by passive investors performed better, which is an intriguing result in light of some policy makers' concerns that the secular shift from active to passive could destabilize markets after negative shocks (Anadu et al., 2018; Sushko and Turner, 2018). Finally, stocks held by long-term investors also performed better, consistent with Cella et al. (2013) on prior periods of market turmoil. All these results indicate that companies should be mindful of their shareholder base, including the stock price fragilities deriving from the broader portfolio positions of their investors.[5]

Second, to shed more light on the behavior of institutional investors when a disaster hits, we analyze how institutions rebalanced their equity portfolios in the first quarter of 2020.[6] The firm-level IO changes from the end of 2019-Q4 to the end of 2020-Q1 are significantly more pronounced and skewed in the negative direction than the changes in IO over prior quarters, which are more normally distributed. This is indicative of the unusual selling activity by institutions triggered by the outbreak of the pandemic. Importantly, the selling was not indiscriminate: We find that 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 associated with these corporate characteristics. Interestingly, IO changes are not associated with firms' ES performance. We conclude that, during the COVID-19 crash, institutional investors expressed a preference for financial resiliency but

[5]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.

[6]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 on December 31, 2019. After the wild 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).

not necessarily for corporate sustainability (ES).

Different types of institutions behaved differently. Hedge funds are of particular interest, as their role received great attention after the GFC. In the context of the COVID-19 crash, Ding et al. (2020) document that stocks with greater ownership by hedge funds performed worse. By analyzing actual portfolio changes during 2020-Q1, we quantify that hedge funds indeed sold more than 4% of their aggregate equity portfolio as of the previous quarter. Interestingly, the changes in hedge fund holdings are not explained by specific corporate characteristics. These investors -- presumably in the attempt to deleverage -- engaged in indiscriminate selling of stocks.[7] By contrast, investment companies and investment advisors deleveraged by rebalancing their portfolio away from stocks of companies with high leverage or low cash. Finally, contrary to what is perhaps the common narrative about their social preferences and long-term orientation, pension funds actually decreased their holdings of firms with strong ES scores.

Third, 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 institutional ownership (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 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.[8] We find that the change in the number of RH investors in

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

[8]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).

individual stocks over the first quarter of 2020 indeed exhibited opposite patterns to the changes in institutional ownership. In particular, in March 2020, retail interest substantially increased for stocks with high leverage and low cash holdings.

Overall, the results suggest that when an exogenous tail event occurs, institutional investors amplify market crashes. In the COVID-19 crisis, these investors prioritized hard measures of firm resilience (high cash and low leverage) over soft measures (ES issues). The stock price penalty associated with a company's financial weakness appears to be driven by the selling pressure by institutional investors attempting to derisk their portfolios. Our proxy of retail traders indicates that individual investors took contrarian positions and acted as (partial) liquidity providers.

We conclude the paper by examining the second quarter of 2020. We find that, despite the injection of liquidity by the Fed and the aggregate market rally, institutional investors did not reverse their risk-averse investment strategies. 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. Also consistent with the first quarter, Robinhood users continued expressing complementary preferences to their institutional counterparts.

Our paper relates to three major strands of literature. First, it contributes to the understanding of institutional investors' behavior during crisis episodes. Gabaix et al. (2006) present a model in which institutional investors increase market volatility, and Coval and Stafford (2007) show that common ownership by institutional investors increases the downward pressure on prices during asset fire sales. A major driver of institutional fire sales is also the risk of having to respond to massive redemptions (Chernenko and Sunderam,

2020; Manconi et al., 2012; Simutin, 2014). Cella et al. (2013) show that during the GFC, stocks held by more short-term institutional investors performed worse. Greenwood and Thesmar (2011) document that firms with higher institutional ownership are more susceptible to non-fundamental shifts in demand for their stocks, and hence are more ''financially fragile''. Anand et al. (2013) show that during the GFC institutional investors usually behaving as liquidity suppliers ceased to do so, significantly slowing down the price recovery of assets. Our results suggest that institutional ownership indeed exacerbated the effects of the COVID-19 market crash, an example of an exogenous tail risk, by fire-selling companies with weak financials and that conversely individual investors served as liquidity providers. Our paper also adds to the ''flight-to-quality'' literature (e.g., Bernanke et al., 1996; Caballero and Krishnamurthy, 2008), as we study which specific firm characteristics institutional investors associated with ''quality'' during a tail risk event.

Second, our paper contributes to the emerging literature studying how heterogeneous preferences across investors and changes in portfolio holdings affect market valuations.[9] We uncover a great deal of heterogeneity in the reactions to COVID-19 among different types of investors. Importantly, we are able to complement the analysis of institutional investors' behavior with an analysis of the behavior of retail investors, further elucidating their role of liquidity providers during market crashes. As such, our paper also contributes to the literature on individual investor behavior during crises. Barrot et al. (2016), for instance, show that individual investors provide liquidity to the stock market in case of fire sales by institutional investors (and are compensated for doing so). In contemporaneous work, Ozik

[9]Koijen and Yogo (2019) develop a demand system approach to asset pricing, relaxing the traditional assumption of atomistic investors with homogeneous preferences, fully reflected in asset prices. Using this approach, Koijen et al. (2020) analyze institutional investor holdings to estimate the demand of investors for various firm characteristics and understand their relative influence in the price formation process.

et al. (2020) and Welch (2020) also find that RH investors acted as a (small but active) market-stabilizing force during the COVID market crash.[10]

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.[11] A few studies have documented the stock-price effects of the level of institutional ownership in the COVID-19 crash.[12] By analyzing actual portfolio changes in the first quarter of 2020, our paper is the first to study of how institutional investors amplified the price crash by fire-selling. Our work also directly contributes to the literature on firms' access to capital during the pandemic.[13] Institutional investors are usually major providers of capital for corporations. Understanding their behavior during the pandemic -- when many firms would greatly benefit from their support -- is particularly relevant also from a public policy perspective.

[10]Other studies have looked at other groups of individual investors during the COVID crisis. Blanchett et al. (2020) examine the likelihood of changes to investments by 401(k) plan participants and Giglio et al. (2020) study the sentiment of Vanguard clients. Ortmann et al. (2020) show that U.K. retail investors significantly increased their trading activities as COVID-19 unfolded, but they do not investigate which stocks investors flocked to. Amore et al. (2020) find that firms with controlling family shareholders fared better in the crisis. Anginer et al. (2020) show that insiders bought shares of high-leverage and value firms.

[11]Alfaro et al. (2020) show that stock returns respond to daily *unanticipated* changes in COVID-19 cases. Ramelli and Wagner (2020) analyze variation across industries, and the pricing of international exposure, cash, and leverage over time. Fahlenbrach et al. (2020), too, analyze financial flexibility of firms. Landier and Thesmar (2020) study analysts' forecast revisions. Albuquerque et al. (2020), Demers et al. (2020), Garel and Petit-Romec (2020), and Mahmoud and Meyer (2020) investigate the role of ES performance. Pagano et al. (2020) find that firms in industries less affected by social distancing outperformed. Studies on international stock price reactions include Ding et al. (2020), Gerding et al. (2020), and Ru et al. (2020).

[12]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 more for firms with 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 investors with a longer-term orientation. For Japanese firms, Takahashi and Yamada (2020) find that ownership by traditional business groups (by foreign investors) is positively (negatively) associated with abnormal returns.

[13]For example, 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, especially large ones, acted as lenders of first resort for firms in search of liquidity. Halling et al. (2020) study bond and equity issuance activities and find that in the first quarter of 2020, the capital raised by US firms 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, highlighting the crucial challenge of providing these firms with fresh equity.

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.[14] 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. *IO Long-term* 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).[15] *IO Passive* is the level of ownership held by passive investors (index funds and ETFs). *IO Foreign* is the level of ownership held by non-domestic investors (Ferreira and Matos, 2008). *LowFlowsInCrisisIO* is the

[14]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.

[15]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.

level of ownership by institutional investors who experienced below-median investor flows during the GFC.[16] We also calculate other portfolio-level investor characteristics to test the "fire sales" channel. *HighLeverageIO*, *LowCashIO* and *LowEsIO* are the levels of ownership by institutional investors with above-median portfolio exposure to *Leverage*, below-median portfolio exposure to *Cash/assets* and *ES (msci)*, respectively.[17]

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 million users traded on this electronic platform at the end of 2019.[18] 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

[16]We calculate *LowFlowsInCrisisIO* 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.

[17]We calculate *HighLeverageIO*, *LowCashIO*, and *LowEsIO* 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.

[18]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).

population US retail investors, they represent 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.[19] 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 and firm characteristics

Firms' stock returns and accounting 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).[20] 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 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.[21] *Stock illiquidity* is the Amihud illiquidity

[19]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).

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

[21]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

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.

Accounting data comes 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.[22] Appendix Table A1 provides detailed definitions of our variables of interest (*Cash/assets*, *Leverage*) and control variables (*log(Market cap)*, *Profitability*, *Book-to-market*).[23]

We obtain information on firms' environmental and social 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 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). We define the variable *ES (asset4)* as the average of the scores on the environmental and the social pillars. Regressions employing either of these two ES scores have fewer observations, but still good coverage overall.

returns (obtained from Kenneth French's website) throughout 2019.

[22] 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.

[23] In results available upon request, we also ensured that all our results remain unchanged when accounting 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 (p-value=1.58).

2.3 Descriptive statistics

Table 1 provides 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) of Panel A 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.[24] Economically, a one standard deviation higher IO_{2019Q4} corresponds to one-tenth lower standard deviation in cumulative *Fever* returns.

[24]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.

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

Importantly, the estimated stock price impact of IO controls for the level of stock illiquidity before the pandemic. This is a potentially important control as IO and illiquidity tend to be strongly negatively correlated. The extant literature shows that investors require a premium to hold more illiquid stocks (Amihud, 2002; Pástor and Stambaugh, 2003; Acharya and Pedersen, 2005). 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).[25]

In column (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.[26] Despite the smaller sample size, the impact of

[25]Our results remain unchanged also when controlling for a stock's liquidity risk exposure (aka 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).

[26]Online Appendix Table OA1 displays similar results with *ES score (asset4)*, 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

IO is unaffected by controlling for ES scores.

Columns (3) to (6) examine investor heterogeneity in terms of activeness, horizon, domicile, and redemption risk. Column (3) indicates that a higher percentage of $PassiveIO_{2019Q4}$ is associated with more resilience, suggesting that price changes were caused by trades of actively managed institutional portfolios.[27] Column (4) indicates that a higher percentage of long-term institutional ownership is associated with relatively better stock price performance. This result on $Long\text{-}termIO_{2019Q4}$ 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. Finally, column (6) indicates that stocks with higher ownership by investors that saw above-average outflows during the GFC ($LowFlowsInCrisisIO_{2019Q4}$) 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.

For robustness, we re-estimate the regressions in Panel A of Table 2 using CAPM-adjusted and FF-adjusted returns instead of raw returns. Online Appendix Table OA2 shows very

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.

[27] Our evidence is consistent with anecdotal evidence on the increased 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.

similar inferences. This is as expected, as institutional ownership has very low correlation with any of the factor loadings. In the Online Appendix Table OA3, we split the sample into Russell 3000 members that are part of the S&P 500 index and those outside of this major stock benchmark. We find that the negative relation between IO_{2019Q4} and COVID-related stock returns has higher statistical significance in Russell 3000 firms outside of the S&P500 index. Consistently, the heterogeneity effects among institutional holders are also stronger for the non-S&P 500 firms than for the S&P 500 firms.

3.2 Heterogeneous exposure of institutional investors

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'' (Coval and Stafford, 2007). Under this view, high-IO firms were more ''financially fragile'' (Greenwood and Thesmar, 2011) and susceptible to non-fundamental shifts in demand.[28]

In Panel B of Table 2, we explore the role of IO portfolio characteristics to test the ''fire sales'' channel. 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 (see columns (2) and (4)). While prior literature has identified financial strength as a major determinant of firms' cash-flow prospects during crises (including during COVID-19), our

[28]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.

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 strongly concentrated in those firms that, besides weak finances, also have institutional investors that are strongly exposed to such type of companies in their portfolios.

In column (5) and (6), we investigate the effects of the exposure of institutional investors to firms with low ES scores. If the out-performance associated with firms' sustainability policies was driven by institutional investors, we would expect the ES score to be of particular value to investors with portfolios poorly exposed to this dimension (similarly to what we observed with cash holdings), but we do not observe such an effect.[29] This non-result speaks against the presence of a significant onrush to ESG by institutional investors as an immediate reaction to COVID-19.[30]

Overall, stock prices indicate that institutional investors have been main actors in the COVID-19 market crash and in the relative re-pricing of stocks based on firms' financial policies.

[29]We obtain similar estimates when classifying the ES preferences of investors based on their tilt along ES scores from Asset4 and also if they are signatories of the UN-backed PRI, as done in Gibson, Glossner, Krueger, Matos, and Steffen (2020).

[30]In an unreported robustness check, we use tercile splits instead of median splits to identify institutional investors holding high-leverage, low-cash, or low-ES portfolios. We find mostly qualitatively similar results as in Panel B of Table 2. When using a tercile split, the amplification effect of HighLeverageIO on the stock price effect of leverage is slightly weaker than with a median split.

4 Changes in total institutional ownership and retail investor interest

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 2 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.[31]

Figure 2 about here

4.1 Drivers of institutional ownership changes

What explains the cross-section of changes in institutional ownership during the COVID-19 crisis? Do institutional investors value hard resiliency characteristics (cash and leverage) beyond what is reflected in market valuations? Do they value soft characteristics (ES performance)?

Table 3 about here

[31]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.

To answer these questions, Panel A of Table 3 regresses the change in IO over the 2020-Q1 quarter (Δ *IO 2020Q1*) on firm characteristics. In column (1), 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 (2). Firms with one standard deviation higher leverage experienced a 6% of a standard deviation stronger reduction in institutional ownership (-0.008 $\times$ 22.7/3.22).

In column (3), we observe that the stock performance in the *Fever* phase strongly explains the change in institutional ownership in 2020-Q1. Specifically, IO drops more in firms with worse stock price performance (or, equivalently, stock price drops are steeper in firms where IO drops more). This provides support for the notion that the large stock price drops were driven by institutional owners (rather than the alternative that in firms with large institutional ownership other groups of investors sold particularly aggressively).

In column (4), we add firms' ES scores (*ES score (msci)*). Interestingly, institutional investors do not appear to 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.[32]

Panel B of Figure 2 illustrates these results, plotting the relations between the net change in institutional ownership in 2020-Q1 and firm leverage, cash holdings, and environmental

[32]When we use ES scores from Thomson Reuters Refinitiv instead, we find that institutional investors actually tilted their portfolios *against* firms with higher environmental and social performance; see Online Appendix Table OA1.

and social (ES) scores.[33] 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 policy decisions is the result of a mix of both endogenous decisions by corporations and institutional investors' portfolio choices.[34] COVID-19, by contrast, is an exogenous shock that offers a clean opportunity to exploit the portfolio reshuffling by institutional investors to infer their revealed preferences for firm characteristics.

4.2 Retail investors as liquidity providers

If institutions behaved (in aggregate) as net sellers, especially for certain types of stocks, which other market participants took the other side of their trades? Did individual investors act as liquidity providers, hence revealing heterogeneous preferences from their institutional counterparts?

Panel B of Table 3 investigates this question by exploiting retail investor interest data from Robinhood. We regress 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. From column (2), a one standard deviation

[33]The figures do not control for industry fixed effects to provide additional information relative to Table 3. The figures look quite similar when including fixed effects.

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

higher leverage led to a 6% of a standard deviation higher increase in popularity among retail investors (-0.043 ×22.7/15.14). The one exception is high-ES companies which, similar to institutional investment, also did not generate additional interest from this group of retail investors.

Panel A of Figure 3 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 3 about here

Figure 4 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 3 for each day using the year-to-date percentage change in Robinhood users. We notice that Robinhood users show an increasing interest 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.[35]

[35]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.

Figure 4 about here

4.3 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 conduct two placebo tests to probe whether this behavior is special to this tail risk phase and a matter of active IO response.

First, in Table 4 in Panel A, we re-estimate the regressions in Table 3 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 (see Panel A in Online Appendix Table OA3), did not experience significant net outflows of institutional ownership.

Table 4 about here

Second, in Panel B of Table 4, 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.

5 Portfolio changes by institutional investor category

In the previous section, we presented evidence that the COVID-19 shock caused major changes in the investor base of firms depending on their financial metrics, with institutional investors exiting high-debt and low-cash firms, and being replaced by individual investors. We interpret these observed shifts in stock holdings as the result of heterogeneous changes in preferences, which are only partially reflected in market prices.

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 (hedge funds, pension funds, mutual funds, and investment advisors) 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: $\Delta \textit{Equity positions}_{i,2020Q1} = \sum_{j \in S}(IO_{i,j,2020Q1} - IO_{i,j,2019Q4}) \times \textit{Market cap}_{j,2019Q4}$, 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. $\textit{Market cap}_{j,2019q4}$ 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 5 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.[36] Hedge funds divested significantly more in absolute and relative numbers than pension funds, mutual funds, or investment advisors.

Figure 5 about here

Table 5 about here

In Table 5 we study the determinants of the change in stock ownership by the four categories of institutional investors. Columns (1) and (2) show that hedge funds do not appear to have changed their overall exposure to corporate cash and leverage, despite their massive divestment during the first quarter of 2020. Presumably, these investors decreased their own leverage by selling everything in their portfolios, perhaps even starting from the most liquid stocks.

Pension funds, often perceived as long-term investors, appear to have exited high-leverage firms (columns (3) and (4)). Interestingly, they appear to have slightly divested as well from high ES firms, in contrast with some narratives on the increased importance of ES(G) issues for institutional investors during the COVID crisis.[37]

[36]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).

[37]UN-Backed Principles for Responsible Investment, ''How responsible investors should respond to the COVID-19 coronavirus crisis'' (March 27, 2020).

Mutual funds (columns (5) and (6)) appear to have slightly decreased their overall exposure to highly-leverage firms, though this result is not robust. This could be due to the fact that this category of investors includes many passive investors, which by definition do not have incentives to tilt their portfolios away from what is determined by the current market valuations.

Finally, the investment advisor category appears to have strongly discriminated between firms on the basis of their financial positioning (columns (6) and (7)). In conjunction with the stock price effects, this result is consistent with Koijen, Richmond, and Yogo (2020), who show that the asset demand by active investment advisors has a relatively large influence on market valuation relative to other type of institutional investors.

Overall, the results in this section suggest considerable heterogeneity in how different types of institutional investors reacted to the COVID-19 shock, both in terms of total equity position change and in terms of revealed preferences for firm characteristics.

6 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. The Fed's interventions announced on March 23 and significantly expanded on April 9, under the promise of a massive injection of liquidity (D'Amico et al., 2020; Haddad et al., 2020), reassured investors and paved the way for a swift reversal of major indexes. The second quarter is regarded as being characterized by a feeling of exuberance, but individual companies

fared very unequally.[38] By June 30, 2020, only 28% of the firms in our sample had fully recovered from the losses of 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.

We start by re-assessing the stock-price effect and the changes of institutional ownership between April and June 2020. As Panel A of Figure 6 shows, in the second quarter of 2020 institutional ownership is uncorrelated with stock returns. When looking at changes in IO of individual firms (Online Appendix Figure OA4), we observe that, while some firms continued experiencing an 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 abnormally wide compared to 2020-Q1 and previous quarters (recall Online Appendix Figure OA2 for a comparison), indicating an unusually hectic period for institutional investors, both on the selling and buying sides.

Figure 6 about here

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,

[38] 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)).

however, seem to indicate the opposite: Panel B of Figure 6 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. Consistent with this, Table 6 and Online Appendix Figure OA6 document that institutional investors continued shifting their portfolios towards high-cash and low-debt firms in 2020-Q2. Studying the holdings of retail investors, we find that Robinhood users kept expressing complementary preferences to their institutional counterparts in 2020-Q2.[39]

Table 6 about here

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 still high uncertainty of financial market participants with respect to economic growth and corporate debt.

7 Conclusion

In this study we shed light on the role of institutional investors in the COVID-19 stock market collapse and, more generally, their preferences for specific firm characteristics when a tail risk realizes. 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

[39]Robinhood users kept showing a preference for high-debt firms in 2020-Q2, less so for low-cash firms (Panel B of Table 6 and Online Appendix Figure OA7). We further notice that Robinhood users uniformly increased their investments across all industries (Panel B of Online Appendix Figure OA5).

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. 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. 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.

At the time of writing this paper, the COVID-19 pandemic has not yet been contained and markets are still in flux. Although U.S. stock markets recovered their losses, we find evidence that in the second quarter of 2020 institutional investors kept expressing preferences for companies with strong financials and did not reinvest in the companies they sold in 2020-Q1. We interpret this finding as a signal of the still elevated concerns by institutional investors regarding the evolving COVID-19 crisis: How will the number of coronavirus cases evolve in the U.S.? What will be the time to develop and distribute a vaccine? How quickly will the economy recover after the pandemic? Future research could look into how institutional and retail investors will continue to reposition their portfolios as the pandemic evolves.

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Figures

Figure 2: 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.

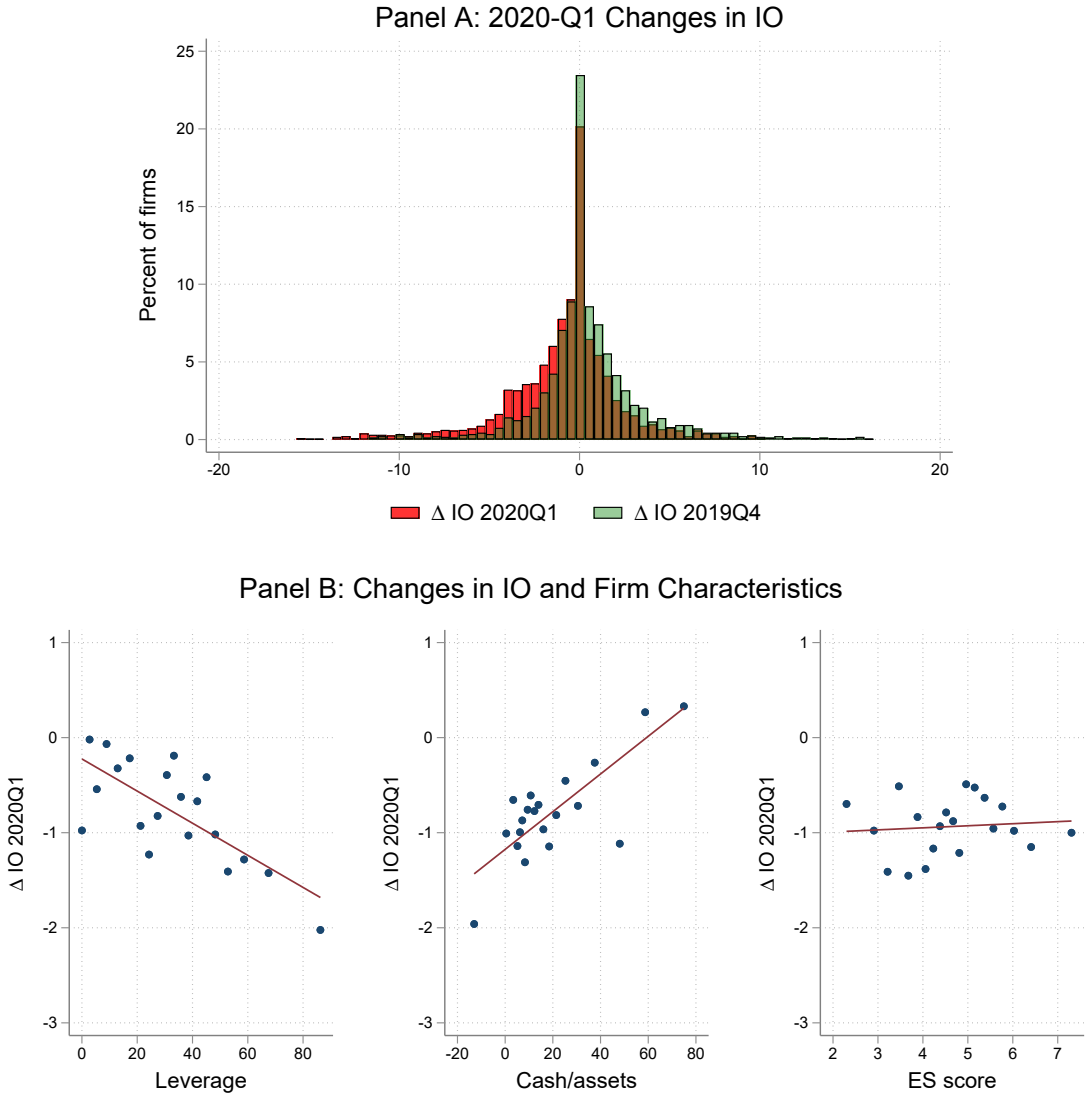


Figure 3: Change in retail investor popularity against the change in institutional ownership

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.

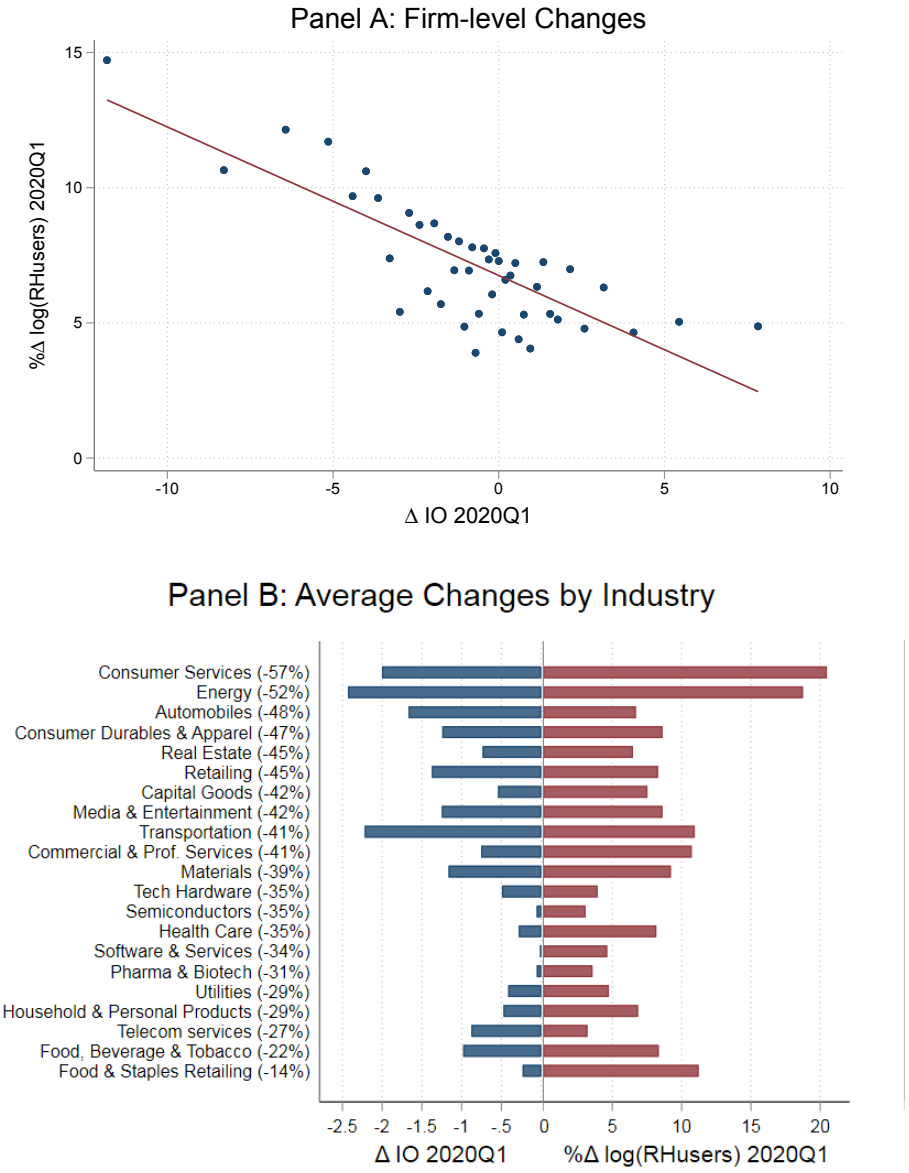


Figure 4: Retail investor interest and firm characteristics
These graphs show the day-to-day evolution of retail investor interest in cash, leverage, and ES performance. Each point is the coefficient on either Cash/assets, Leverage, or ES (msci) from OLS regressions of the percentage change in log Robinhood 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.

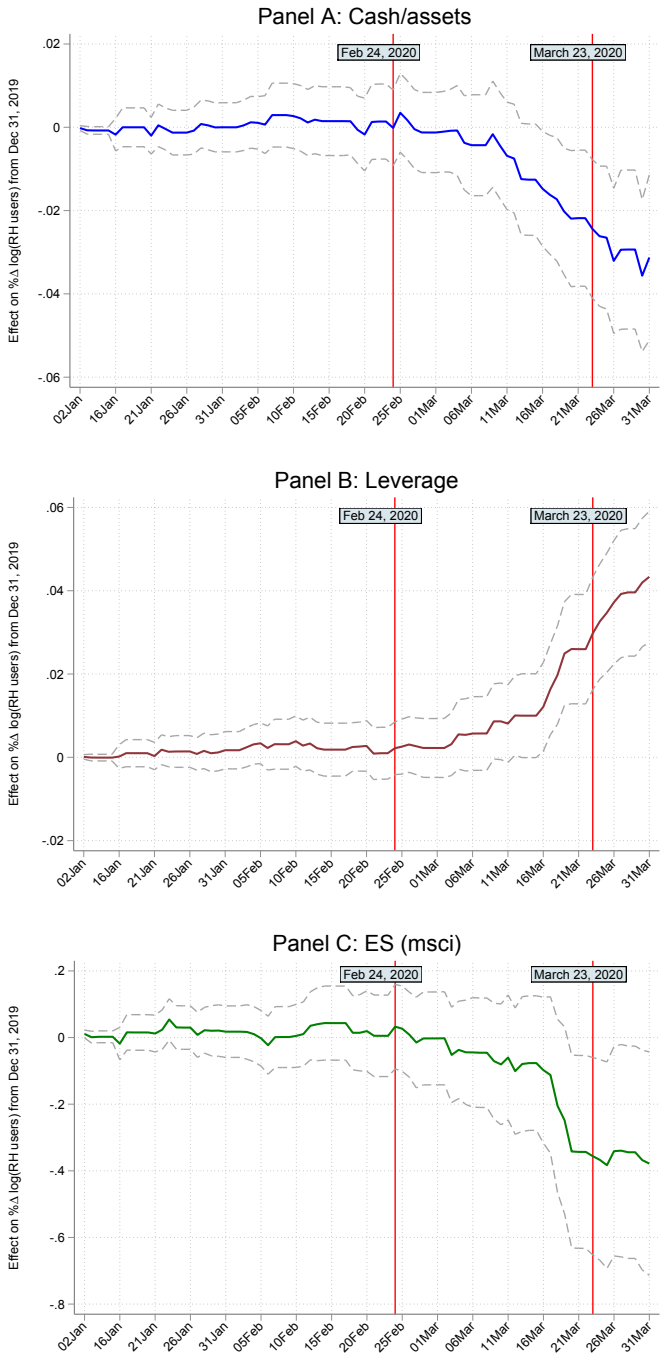


Figure 5: Net change in equity positions by investor category
These graphs show the net changes in equity positions between 2019-Q4 and 2020-Q1 due to active trading by institutional investor category. These changes are estimated based on the ownership by investor category of non-financial Russell 3000 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.

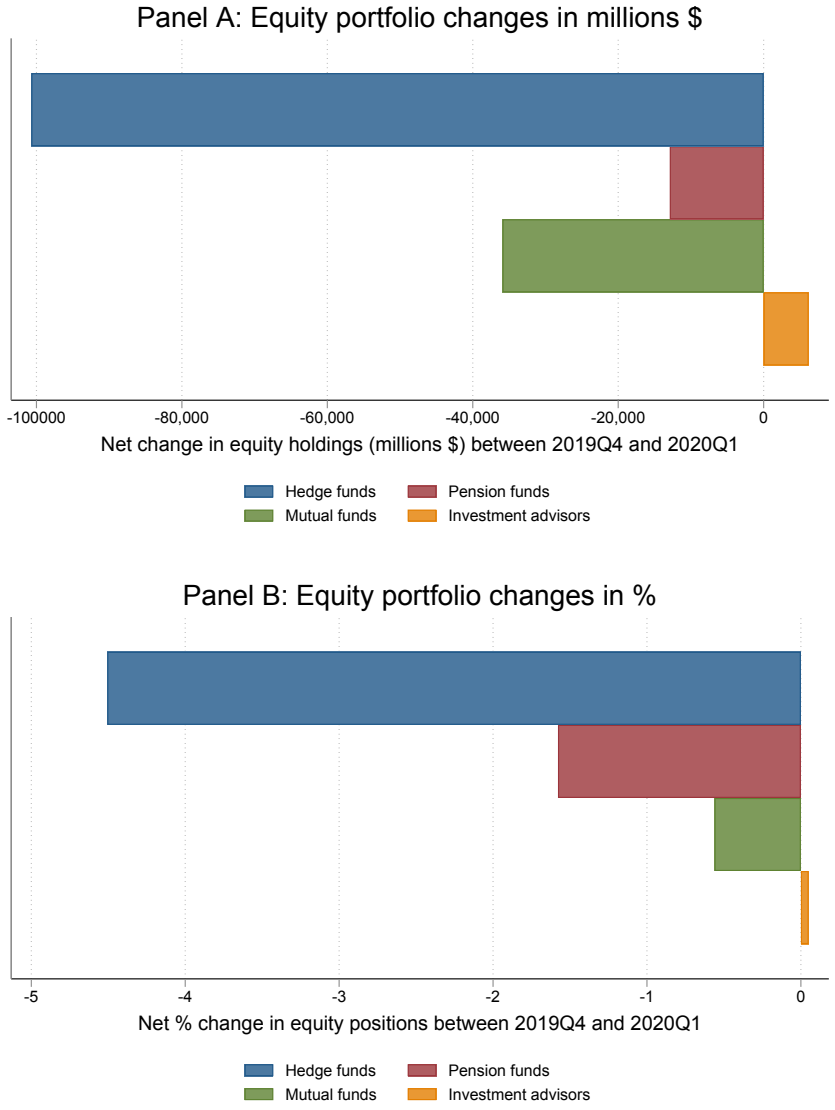
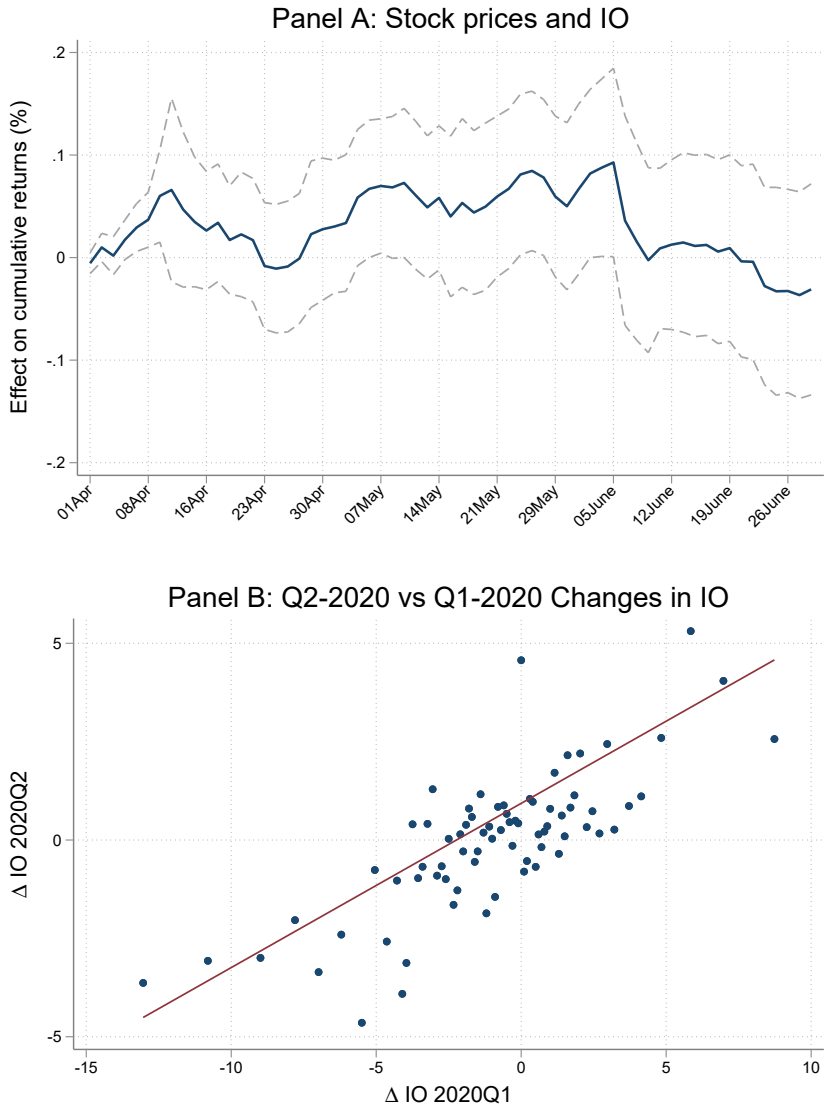


Figure 6: Stock returns during 2020-Q2 and correlation of changes in IO in 2020-Q2 vs 2020-Q1

Panel A shows the evolution of the coefficients on 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. Panel B shows a binned scatterplot of Δ *IO 2020Q2* against Δ *IO 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
$LowFlowsInCrisisIO_{2019Q4}$	2,274	0.00	13.93	19.53	19.28	24.70	90.05	9.22
$HighLeverageIO_{2019Q4}$	2,274	0.00	43.93	54.24	57.51	66.75	97.19	17.96
$LowCashIO_{2019Q4}$	2,274	0.00	12.65	22.00	21.64	30.00	100.00	13.35
$LowEsIO_{2019Q4}$	2,274	0.00	41.73	53.42	55.74	67.31	100.00	18.07
$IOhedgefunds_{2019Q4}$	2,281	0.05	6.29	13.59	10.30	17.78	75.35	10.38
Δ IOhedgefunds 2020Q1	2,237	-8.39	-1.35	-0.15	-0.28	0.86	9.91	2.50
$IOpensionfunds_{2019Q4}$	2,281	0.03	0.87	1.97	1.77	2.65	18.68	1.53
Δ IOpensionfunds 2020Q1	2,237	-1.68	-0.19	-0.09	-0.03	0.06	1.29	0.34
$IOmutualfunds_{2019Q4}$	2,281	0.18	12.29	19.01	19.23	25.32	50.74	9.01
Δ IOmutualfunds 2020Q1	2,237	-7.14	-0.69	0.01	0.07	0.84	5.54	1.70
$IOadvisors_{2019Q4}$	2,281	0.77	34.55	43.69	45.84	54.75	90.36	15.11
Δ IOadvisors 2020Q1	2,237	-13.50	-2.07	-0.64	-0.39	1.03	7.94	3.01
$RHusers_{2019Q4}$	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, accounting information, and environmental and social performance								
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
ES score (asset4)	1,634	10.15	13.82	34.15	21.61	48.65	95.90	26.32

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). Panel A shows the stock price effect of institutional ownership, and its heterogeneity by investor category. Panel B shows the effects of the interaction between institutional investors' portfolio composition and firm characteristics. 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: Main effects of institutional ownership						
	(1)	(2)	(3)	(4)	(5)	(6)
	Dependent variable: Return in Fever (Feb24-Mar20, 2020)					
IO_{2019Q4}	-0.069***	-0.056**	-0.104***	-0.249***	-0.076***	-0.043*
	(-2.92)	(-1.97)	(-3.68)	(-4.68)	(-3.22)	(-1.74)
$PassiveIO_{2019Q4}$			0.169**			
			(2.55)			
$Long\text{-}termIO_{2019Q4}$				0.228***		
				(4.15)		
$ForeignIO_{2019Q4}$					0.083***	
					(2.82)	
$LowFlowsInCrisisIO_{2019Q4}$						-0.106**
						(-2.38)
Leverage	-0.105***	-0.135***	-0.100***	-0.094***	-0.108***	-0.100***
	(-4.67)	(-5.47)	(-4.43)	(-4.17)	(-4.84)	(-4.46)
Cash/assets	0.086***	0.146***	0.095***	0.108***	0.087***	0.087***
	(3.55)	(5.11)	(3.90)	(4.43)	(3.60)	(3.61)
ES score (msci)		0.801**				
		(2.18)				
Market beta	-6.505***	-8.368***	-6.531***	-6.549***	-6.459***	-6.579***
	(-6.06)	(-6.57)	(-6.09)	(-6.13)	(-6.02)	(-6.15)
Stock illiquidity	0.665***	0.448	0.753***	0.651***	0.659***	0.668***
	(2.80)	(0.91)	(3.15)	(2.78)	(2.77)	(2.81)
log(Market cap)	1.313***	0.933***	1.321***	0.918***	1.135***	1.305***
	(4.55)	(3.06)	(4.58)	(2.88)	(3.74)	(4.52)
Profitability	0.193*	0.355**	0.188*	0.196*	0.197*	0.198*
	(1.72)	(2.23)	(1.68)	(1.76)	(1.76)	(1.75)
Book-to-market	0.364	0.460	0.374	0.574	0.248	0.287
	(0.44)	(0.44)	(0.45)	(0.69)	(0.29)	(0.34)
Constant	-35.131***	-34.235***	-36.351***	-33.214***	-33.914***	-35.045***
	(-9.10)	(-7.56)	(-9.41)	(-8.37)	(-8.61)	(-9.08)
Observations	2,234	1,649	2,234	2,234	2,234	2,227
R-squared	0.233	0.318	0.235	0.241	0.237	0.234
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes

[Continued from the previous page]

Panel B: Interactions with institutional portfolio characteristics

	(1)	(2)	(3)	(4)	(5)	(6)
	Dependent variable: Return in Fever (Feb24-Mar20, 2020)					
IO_{2019Q4}	-0.045	-0.057**	-0.063**	-0.076***	-0.036	-0.037
	(-1.60)	(-2.01)	(-2.58)	(-3.06)	(-0.99)	(-1.02)
$HighLeverageIO_{2019Q4}$	-0.045	0.109**				
	(-1.42)	(2.07)				
$HighLeverageIO_{2019Q4}$ × Leverage		-0.004***				
		(-3.15)				
$LowCashIO_{2019Q4}$			-0.029	-0.096**		
			(-0.79)	(-2.30)		
$LowCashIO_{2019Q4}$ × Cash/assets				0.009***		
				(4.14)		
$LowEsIO_{2019Q4}$					-0.032	-0.002
					(-0.76)	(-0.02)
$LowEsIO_{2019Q4}$ × ES score (msci)						-0.006
						(-0.37)
Leverage	-0.098***	0.110	-0.103***	-0.101***	-0.134***	-0.135***
	(-4.21)	(1.43)	(-4.56)	(-4.46)	(-5.43)	(-5.45)
Cash/assets	0.082***	0.096***	0.081***	-0.010	0.145***	0.145***
	(3.35)	(3.93)	(3.23)	(-0.28)	(5.03)	(5.05)
ES score (msci)					0.777**	1.119
					(2.10)	(1.23)
Constant	-34.598***	-41.514***	-34.609***	-33.413***	-32.022***	-33.501***
	(-8.89)	(-11.31)	(-8.82)	(-8.38)	(-5.85)	(-5.21)
Observations	2,227	2,227	2,227	2,227	1,645	1,645
R-squared	0.233	0.240	0.233	0.239	0.319	0.319
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes

Table 3: Determinants of changes in institutional ownership and retail popularity
This table shows OLS regression results of the change in institutional ownership or retail interest between 2019-Q4 and 2020-Q1 on firm characteristics. The dependent variable in Panel A is the change in the percentage of institutional ownership (Δ *IO 2020Q1*), while in Panel B it is the percentage change in log Robinhood users (*%*Δ *log(RHusers) 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)
Panel A: Dependent variable: Δ *IO 2020Q1*				
Leverage	-0.008**	-0.008**	-0.006	-0.005
	(-2.07)	(-2.09)	(-1.39)	(-1.04)
Cash/assets	0.008*	0.007	0.006	0.006
	(1.92)	(1.59)	(1.31)	(1.27)
IO_{2019Q4}		-0.014***	-0.012***	-0.007
		(-3.97)	(-3.60)	(-1.60)
Return in Fever			0.019***	
			(3.51)	
ES score (msci)				-0.069
				(-1.08)
log(Market cap)	0.253***	0.267***	0.238***	0.267***
	(5.39)	(5.67)	(4.92)	(4.70)
Profitability	0.026	0.029*	0.023	0.019
	(1.61)	(1.86)	(1.44)	(0.94)
Book-to-market	-0.185	-0.156	-0.159	-0.140
	(-1.31)	(-1.11)	(-1.11)	(-0.90)
Stock illiquidity	0.121***	0.066**	0.053	0.088
	(4.07)	(1.97)	(1.54)	(1.09)
Constant	-2.642***	-1.593***	-0.784	-2.050***
	(-5.76)	(-3.02)	(-1.34)	(-2.79)
Observations	2,198	2,198	2,197	1,629
R-squared	0.068	0.074	0.085	0.063
Industry FE	Yes	Yes	Yes	Yes
Panel B: Dependent variable: *%*Δ *log(RHusers) 2020Q1*				
Leverage	0.025***	0.043***	0.031***	0.048***
	(2.65)	(4.51)	(3.02)	(3.99)
Cash/assets	-0.058***	-0.033***	-0.024*	-0.049***
	(-4.76)	(-2.70)	(-1.92)	(-2.91)
$\log(RHusers_{2019Q4})$		-1.579***	-1.590***	-1.472***
		(-12.91)	(-13.13)	(-9.85)
Return in Fever			-0.115***	
			(-4.58)	
ES score (msci)				-0.422**
				(-2.10)
Constant	7.594***	11.232***	5.636***	13.092***
	(6.52)	(9.71)	(3.31)	(8.11)
Observations	2,169	2,169	2,168	1,611
R-squared	0.173	0.235	0.280	0.239
Controls	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes

Table 4: 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)
Panel A: Dependent variable: Δ *IO 2020Q1* for S&P 500				
Leverage	-0.002	-0.002	0.002	-0.001
	(-0.30)	(-0.19)	(0.32)	(-0.15)
Cash/assets	0.005	0.004	0.004	0.007
	(0.56)	(0.47)	(0.38)	(0.70)
IO_{2019Q4}		-0.020	-0.018	-0.021
		(-1.50)	(-1.30)	(-1.49)
Return in Fever			0.034***	
			(2.66)	
ES score (msci)				-0.003
				(-0.04)
Constant	-0.570	2.242	3.647	2.204
	(-0.44)	(0.91)	(1.47)	(0.86)
Observations	421	421	421	399
R-squared	0.111	0.118	0.144	0.106
Firm controls	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Panel B: Dependent variable: Δ *PassiveIO 2020Q1*				
Leverage	0.002	0.002	0.002	0.002
	(1.49)	(1.61)	(1.17)	(1.42)
Cash/assets	-0.002	-0.002	-0.002	-0.003
	(-1.57)	(-1.22)	(-1.01)	(-1.44)
$PassiveIO_{2019Q4}$		0.007*	0.007*	0.000
		(1.76)	(1.80)	(0.01)
Return in Fever			-0.004**	
			(-2.30)	
ES score (msci)				0.037
				(1.45)
Constant	0.909***	0.754***	0.548***	0.941***
	(5.65)	(4.26)	(2.83)	(3.91)
Observations	2,193	2,193	2,192	1,615
R-squared	0.112	0.113	0.117	0.126
Firm controls	Yes	Yes	Yes	Yes
Industry FE	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. *Hedge funds* include: hedge funds, funds of hedge funds, and private bank wealth managers. *Pension funds* include: pension funds and endowments. *Mutual funds* include: mutual funds and funds of mutual funds. *IO advisors* include: investment advisors and brokers. 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		Δ IO pension funds		Δ IO mutual funds		Δ IO advisors	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Leverage	-0.001	0.003	-0.001**	-0.001**	-0.003	-0.001	-0.008**	-0.010**
	(-0.46)	(0.74)	(-2.39)	(-2.16)	(-1.54)	(-0.42)	(-2.36)	(-2.28)
Cash/assets	-0.002	-0.002	-0.000	-0.001	-0.004	-0.001	0.007*	0.006
	(-0.57)	(-0.41)	(-0.73)	(-1.21)	(-1.64)	(-0.38)	(1.74)	(1.30)
ES score (msci)		-0.047		-0.019**		-0.016		0.054
		(-0.81)		(-2.24)		(-0.41)		(0.81)
$IOhedgefunds_{2019Q4}$	-0.022***	-0.023***						
	(-3.35)	(-2.64)						
$IOpensionfunds_{2019Q4}$			-0.085***	-0.087***				
			(-7.87)	(-6.74)				
$IOmutualfunds_{2019Q4}$					-0.030***	-0.026***		
					(-5.47)	(-4.08)		
$IOadvisors_{2019Q4}$							-0.043***	-0.036***
							(-9.16)	(-6.02)
Stock illiquidity	-0.019	-0.072	0.005***	0.021***	-0.031**	-0.020	0.001	0.003
	(-0.82)	(-1.25)	(2.58)	(3.80)	(-2.49)	(-0.67)	(0.04)	(0.05)
log(Market cap)	-0.070**	-0.063	0.055***	0.062***	-0.051*	-0.055*	0.310***	0.270***
	(-2.09)	(-1.51)	(9.57)	(9.18)	(-1.90)	(-1.65)	(8.00)	(5.60)
Profitability	-0.028**	-0.038**	-0.004***	-0.003	0.027***	0.023*	0.038***	0.052***
	(-2.14)	(-2.20)	(-2.98)	(-1.59)	(3.13)	(1.66)	(3.10)	(2.97)
Book-to-market	-0.182	-0.125	0.006	0.010	0.137*	0.171*	-0.029	-0.055
	(-1.51)	(-0.91)	(0.57)	(0.75)	(1.87)	(1.88)	(-0.28)	(-0.45)
Constant	0.849**	0.854*	-0.327***	-0.302***	1.144***	1.013***	-0.981**	-1.225**
	(2.43)	(1.84)	(-7.81)	(-5.58)	(4.79)	(3.13)	(-2.24)	(-2.01)
Observations	2,196	1,623	2,193	1,622	2,193	1,619	2,195	1,632
R-squared	0.032	0.036	0.110	0.115	0.045	0.037	0.110	0.105
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 6: Determinants of changes in institutional ownership and retail popularity in 2020-Q2

This table shows OLS regression results of the change in institutional ownership or retail investor interest between 2020-Q1 and 2020-Q2 on firm characteristics. The dependent variable in Panel A is the change in the percentage of institutional ownership (Δ *IO 2020Q2*), while the dependent variable in Panel B is the percentage change in log Robinhood users (*%*Δ *log(RHusers) 2020Q2*). 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)
Panel A: Dependent variable: Δ *IO 2020Q2*			
Leverage	-0.021***	-0.021***	-0.012
	(-3.03)	(-2.98)	(-1.50)
Cash/assets	0.023***	0.025***	0.021**
	(2.92)	(3.16)	(2.23)
IO_{2020Q1}		0.020***	0.037***
		(3.06)	(4.42)
ES score (msci)			0.136
			(1.12)
log(Market cap)	0.055	0.030	-0.164*
	(0.69)	(0.38)	(-1.73)
Profitability	-0.014	-0.021	0.015
	(-0.46)	(-0.68)	(0.34)
Book-to-market	-1.204***	-1.234***	-0.692
	(-2.88)	(-2.93)	(-1.53)
Stock illiquidity	-0.311***	-0.232***	-0.453**
	(-4.70)	(-3.17)	(-2.25)
Constant	1.135	-0.365	-1.360
	(1.30)	(-0.36)	(-1.04)
Observations	2,187	2,187	1,617
R-squared	0.126	0.130	0.109
Industry FE	Yes	Yes	Yes
Panel B: Dependent variable: *%*Δ *log(RHusers) 2020Q2*			
Leverage	0.004	0.028***	0.025***
	(0.49)	(3.84)	(2.99)
Cash/assets	-0.030***	-0.007	-0.008
	(-2.96)	(-0.74)	(-0.68)
$\log(RHusers_{2020Q1})$		-1.719***	-1.655***
		(-19.17)	(-16.30)
ES score (msci)			-0.023
			(-0.15)
Constant	9.953***	14.023***	13.112***
	(10.77)	(16.05)	(11.22)
Observations	2,171	2,171	1,605
R-squared	0.084	0.214	0.209
Firm controls	Yes	Yes	Yes
Industry FE	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.
$LowFlowsInCrisisIO_{2019Q4}$	is the percentage of common stocks held by institutional investors that experienced below-median flows during the Global Financial Crisis (between December 2007 and June 2009).
$HighLeverageIO_{2019Q4}$	is the percentage of common stocks held by institutional investors with above-median value-weighted exposure to *Leverage* as of 2019-Q4.
$LowCashIO_{2019Q4}$	is the percentage of common stocks held by institutional investors with below-median value-weighted exposure to *Cash/assets* as of 2019-Q4.
$LowEsIO_{2019Q4}$	is the percentage of common stocks held by institutional investors with below-median value-weighted exposure to *ES (msci)* as of 2019-Q4.
$IOhedgefunds_{2019Q4}$	is the percentage of common stocks held by hedge funds, funds of hedge funds, and private bank wealth managers as of 2019-Q4.
$IOpensionfunds_{2019Q4}$	is the percentage of common stocks held by pension funds and endowments as of 2019-Q4.
$IOmutualfunds_{2019Q4}$	is the percentage of common stocks held by mutual funds and funds of mutual funds as of 2019-Q4.
$IOadvisors_{2019Q4}$	is the percentage of common stocks held by investment advisors and brokers as of 2019-Q4.
$log(RHusers_{2019Q4})$	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 and accounting data Source: Compustat Capital IQ North America	
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.
	Environmental and social performance
	Sources: MSCI IVA and Thomson Reuters Refinitiv
ES score (msci)	is the average of the 2018 environmental and social scores from the MSCI IVA database.
ES score (asset4)	is the average of the 2017 environmental and social scores from Thomson Reuters Refinitiv database (asset4).

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.

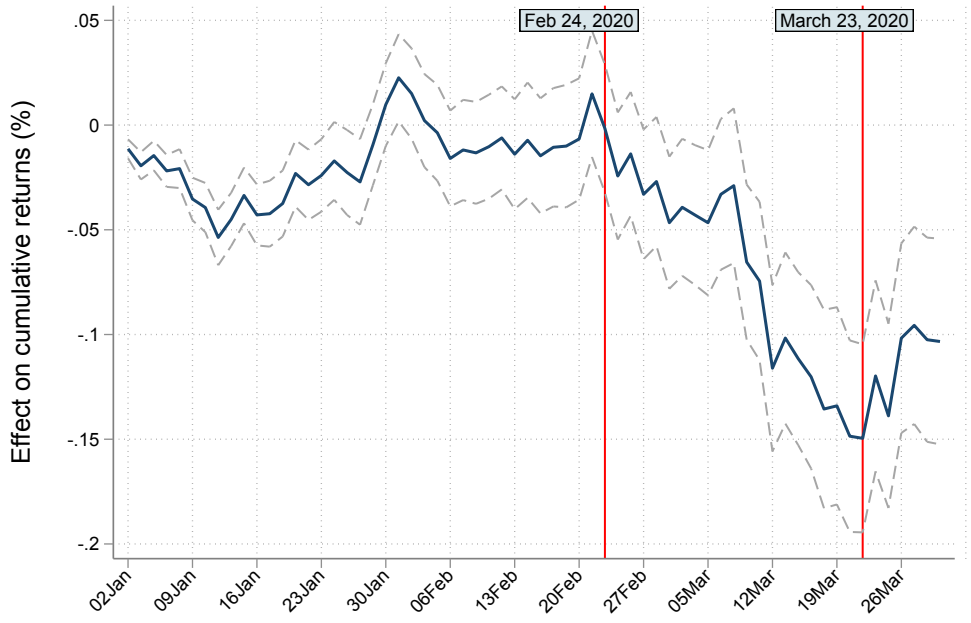


Figure OA2: Quarterly changes in institutional ownership during 2019
These graphs show the distribution of quarter-to-quarter changes in institutional ownership in 2019.

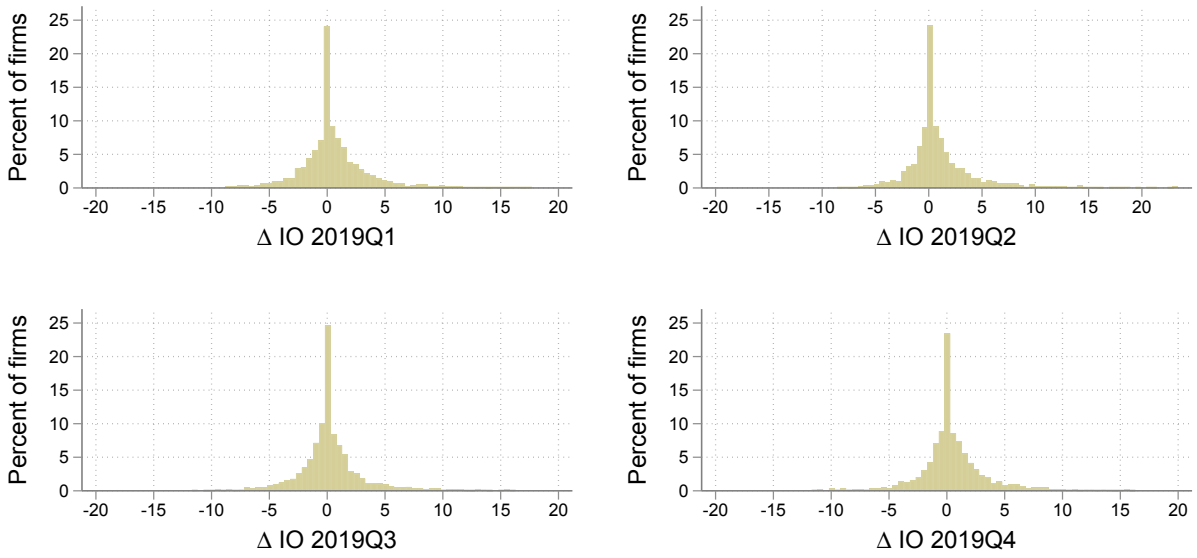


Figure OA3: Changes in IO: S&P500 firms and passive ownership
Panel A compares changes in institutional ownership between 2019-Q4 and 2020-Q1 of non-financial S&P500 firms vs. non-financial Russell 3000 firms not included in the S&P500 index. Panel B compares changes in overall institutional ownership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

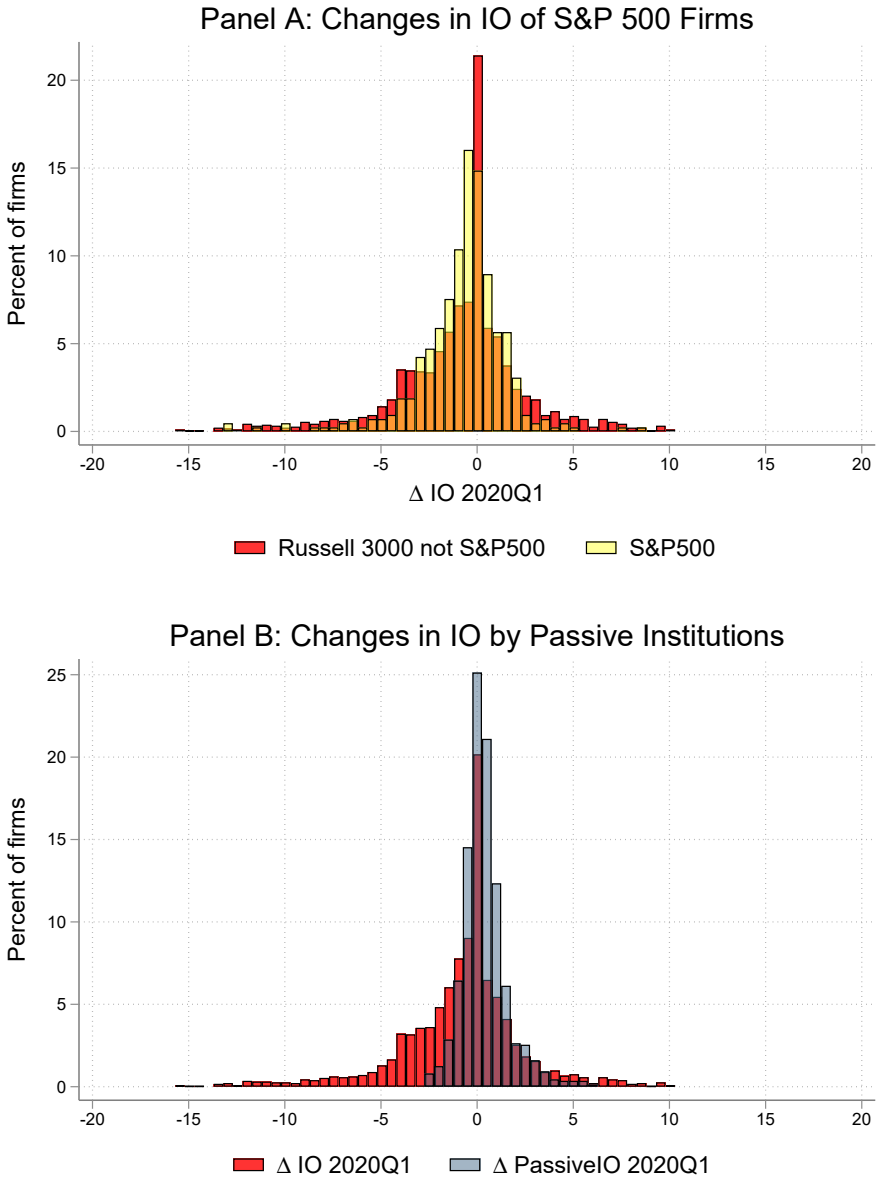


Figure OA4: Changes in IO: 2020-Q2 vs 2020-Q1
The graph shows the distribution of Δ *IO 2020Q2* compared to the distribution of Δ *IO 2020Q1*.

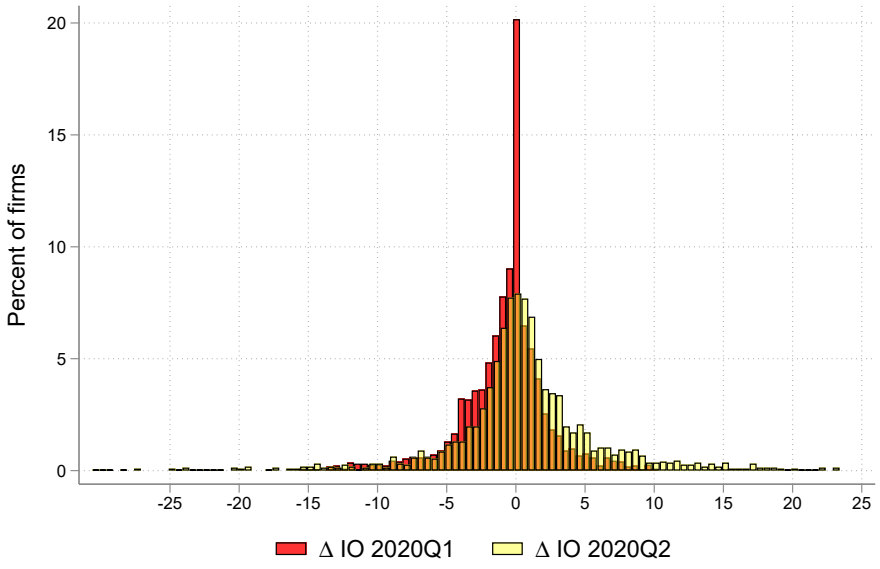


Figure OA5: Change in retail investor popularity against change in institutional ownership during 2020-Q2

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.

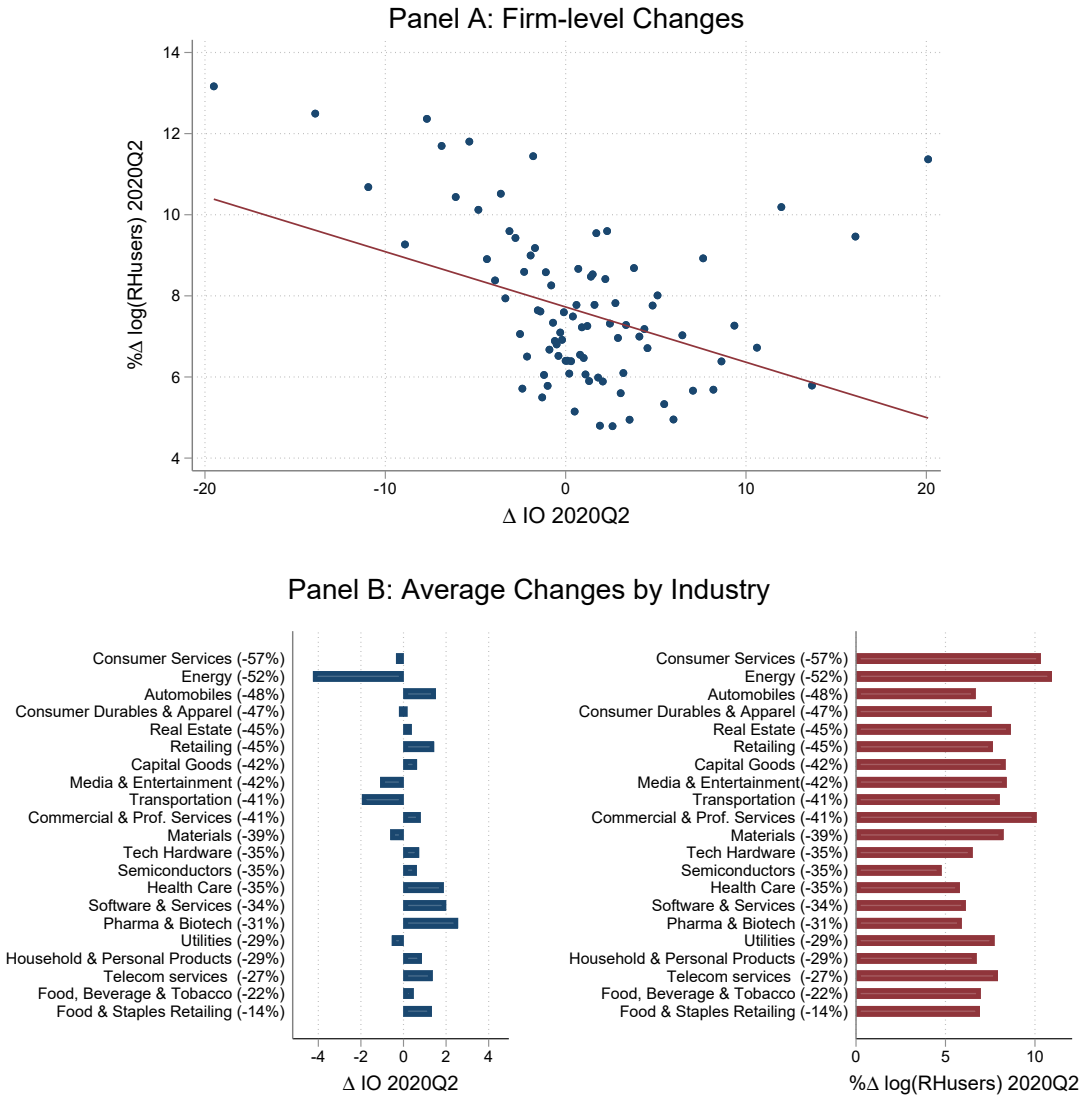


Figure OA6: Change in IO in 2020-Q2 and firm characteristics
Binned scatter plots of the net change in institutional ownership in 2020-Q2 on firm leverage, cash holdings, and environmental and social (ES) scores. The plots control for firm size, profitability, book-to-market, stock illiquidity, as well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

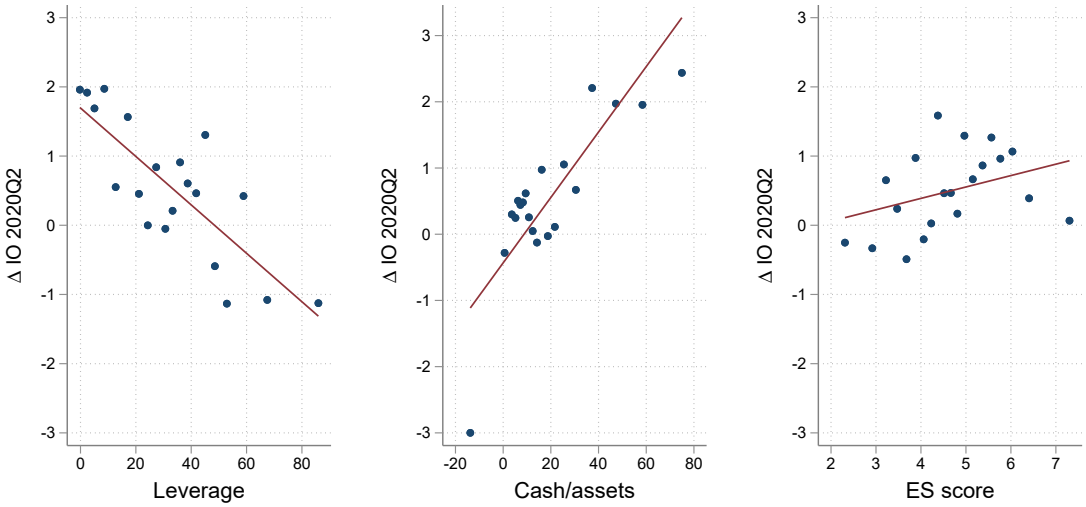


Figure OA7: Evolution of retail investor interest and firm characteristics during 2020-Q2

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.

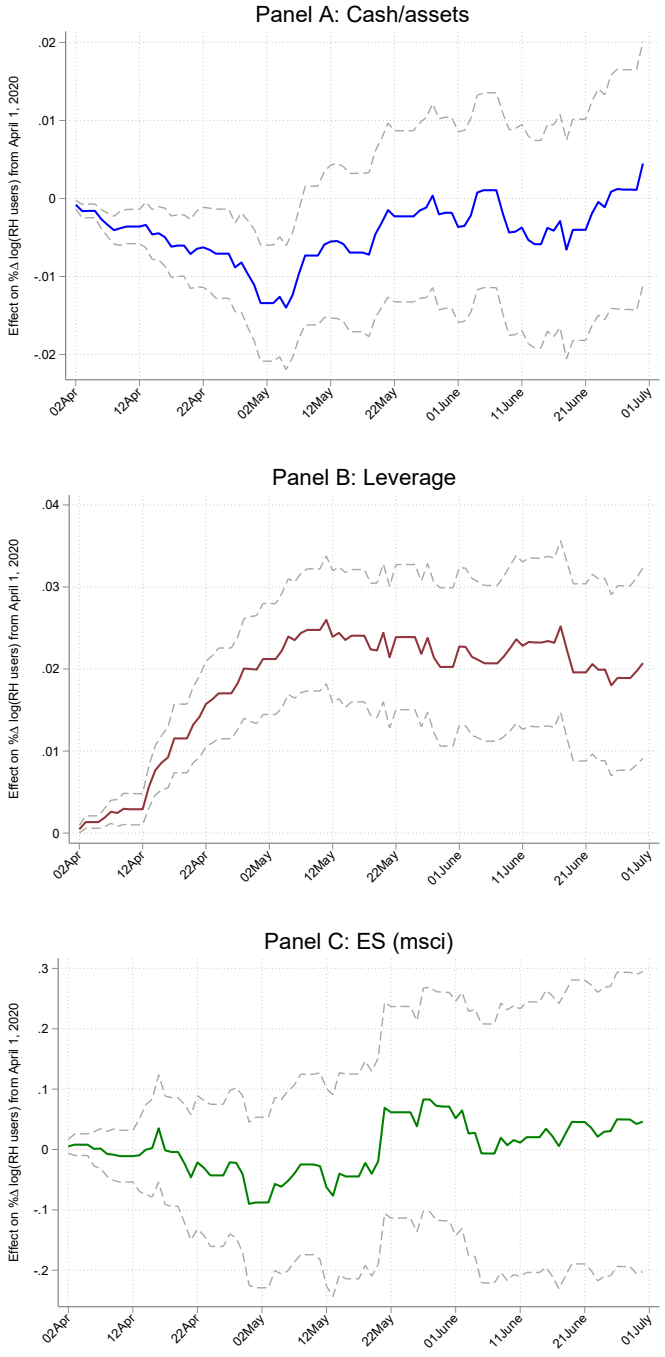


Table OA1: Robustness tests: using Asset4 ESG scores

This table shows OLS regression results of stock returns in the *Fever* period (column (1)), the change in institutional ownership in 2020-Q1 (column (2)), and the percentage change in log Robinhood users in 2020-Q1 (column (3)) on firm characteristics, including the ES score from Asset4. 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)
Dep. variable:	Return in Fever	Δ IO 2020Q1	%Δ log(RHusers) 2020Q1
Leverage	-0.128***	-0.007	0.051***
	(-4.99)	(-1.36)	(4.19)
Cash/assets	0.134***	-0.001	-0.035**
	(4.54)	(-0.16)	(-2.04)
ES score (asset4)	0.041*	-0.010***	0.024*
	(1.88)	(-2.61)	(1.95)
IO_{2019Q4}	-0.047*	-0.011**	
	(-1.68)	(-2.54)	
$\log(RHusers_{2019-Q4})$			-1.534***
			(-10.12)
Market beta	-8.347***		
	(-6.53)		
Stock illiquidity	1.049*	-0.005	-0.195
	(1.94)	(-0.06)	(-0.86)
log(Market cap)	0.772*	0.358***	0.411**
	(1.84)	(4.68)	(2.01)
Profitability	0.294**	0.009	-0.205***
	(2.04)	(0.42)	(-4.23)
Book-to-market	0.243	-0.171	0.730
	(0.22)	(-0.92)	(1.49)
Constant	-31.907***	-2.174***	11.517***
	(-6.92)	(-2.82)	(7.25)
Observations	1,618	1,595	1,576
R-squared	0.287	0.079	0.233
Industry FE	Yes	Yes	Yes

Table OA2: Robustness tests: CAPM-adjusted and Fama-French-adjusted returns

This table shows OLS regression results of CAPM-adjusted and Fama-French-adjusted stock-level returns in the *Fever* period (from February 24 through March 20, 2020), on measures of institutional ownership, and other firm characteristics (Leverage, Cash holdings, ES score, log(Market cap), Stock illiquidity, Profitability, and Book-to-market). Panel A shows the results for CAPM-adjusted returns, while Panel B shows results for Fama-French-adjusted returns. The coefficients on the control variables are not shown for brevity. 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)	(6)
Panel A: Dependent variable: CAPM-adjusted return in Fever (Feb24-Mar20)						
IO_{2019Q4}	-0.079**	-0.059	-0.137***	-0.370***	-0.089**	-0.036
	(-2.06)	(-1.35)	(-3.02)	(-4.31)	(-2.28)	(-0.85)
$PassiveIO_{2019Q4}$			0.279***			
			(2.67)			
$Long\text{-}termIO_{2019Q4}$				0.369***		
				(4.09)		
$ForeignIO_{2019Q4}$					0.104**	
					(2.28)	
$LowFlowsInCrisisIO_{2019Q4}$						-0.180**
						(-2.34)
ES score (msci)		1.115*				
		(1.94)				
Constant	-10.001*	-10.084	-12.068**	-6.986	-8.417	-9.992*
	(-1.65)	(-1.33)	(-1.98)	(-1.12)	(-1.36)	(-1.66)
Observations	2,234	1,649	2,234	2,234	2,234	2,227
R-squared	0.252	0.319	0.254	0.259	0.254	0.253
Panel B: Dependent variable: Fama-French-adjusted Return in Fever (Feb24-Mar20)						
IO_{2019Q4}	-0.061	-0.078	-0.183***	-0.466***	-0.073*	-0.027
	(-1.42)	(-1.48)	(-3.68)	(-4.94)	(-1.68)	(-0.55)
$PassiveIO_{2019Q4}$			0.581***			
			(4.61)			
$Long\text{-}termIO_{2019Q4}$				0.513***		
				(5.09)		
$ForeignIO_{2019Q4}$					0.129***	
					(2.62)	
$LowFlowsInCrisisIO_{2019Q4}$						-0.140
						(-1.54)
ES score (msci)		1.510**				
		(2.17)				
Constant	1.960	10.503	-2.349	6.160	3.922	2.069
	(0.25)	(0.94)	(-0.29)	(0.76)	(0.48)	(0.26)
Observations	2,234	1,649	2,234	2,234	2,234	2,227
R-squared	0.212	0.251	0.220	0.223	0.214	0.214
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes

Table OA3: Stock return effects in and outside S&P500

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, and other firm characteristics (Leverage, Cash holdings, ES score, log(Market cap), Profitability, and Book-to-market). Panel A shows the results for non-financial S&P 500 firms, while Panel B shows the results only for non-financial Russell 3000 firms not included in the S&P 500. The coefficients on the control variables are not shown for brevity. 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: S&P500						
	(1)	(2)	(3)	(4)	(5)	(6)
	Dependent variable: Return in Fever (Feb24-Mar20)					
IO_{2019Q4}	-0.097*	-0.106*	-0.125**	-0.021	-0.100*	-0.095
	(-1.71)	(-1.84)	(-2.10)	(-0.12)	(-1.75)	(-1.43)
$PassiveIO_{2019Q4}$			0.227			
			(1.16)			
$Long\text{-}termIO_{2019Q4}$				-0.091		
				(-0.49)		
$ForeignIO_{2019Q4}$					0.015	
					(0.59)	
$LowFlowsInCrisisIO_{2019Q4}$						-0.007
						(-0.08)
Leverage	-0.114***	-0.108***	-0.112***	-0.116***	-0.113***	-0.114***
	(-2.89)	(-2.67)	(-2.86)	(-2.89)	(-2.85)	(-2.88)
Cash/assets	0.100**	0.113**	0.103**	0.092*	0.101**	0.099**
	(2.04)	(2.28)	(2.14)	(1.78)	(2.06)	(2.03)
ES score (msci)		0.874*				
		(1.72)				
Constant	-20.565*	-19.605*	-27.094**	-21.309*	-20.597*	-20.556*
	(-1.84)	(-1.66)	(-2.04)	(-1.90)	(-1.84)	(-1.84)
Observations	423	401	423	423	423	423
R-squared	0.530	0.550	0.531	0.530	0.530	0.530
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes

[Continued in the next page]

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Panel B: Russell 3000 not S&P500

	(1)	(2)	(3)	(4)	(5)	(6)
	Dependent variable: Return in Fever (Feb24-Mar20)					
IO_{2019Q4}	-0.066***	-0.053*	-0.102***	-0.251***	-0.073***	-0.044*
	(-2.69)	(-1.69)	(-3.40)	(-4.63)	(-2.97)	(-1.69)
$PassiveIO_{2019Q4}$			0.163**			
			(2.33)			
$Long\text{-}termIO_{2019Q4}$				0.234***		
				(4.14)		
$ForeignIO_{2019Q4}$					0.094**	
					(2.56)	
$LowFlowsInCrisisIO_{2019Q4}$						-0.096**
						(-2.01)
Leverage	-0.113***	-0.152***	-0.108***	-0.101***	-0.118***	-0.109***
	(-4.49)	(-5.17)	(-4.27)	(-4.00)	(-4.68)	(-4.29)
Cash/assets	0.088***	0.148***	0.097***	0.111***	0.087***	0.089***
	(3.20)	(4.25)	(3.50)	(4.00)	(3.16)	(3.25)
ES score (msci)		0.628				
		(1.24)				
Constant	-34.498***	-32.748***	-36.284***	-32.958***	-33.104***	-34.903***
	(-6.69)	(-5.35)	(-6.97)	(-6.31)	(-6.32)	(-6.75)
Observations	1,811	1,248	1,811	1,811	1,811	1,804
R-squared	0.208	0.285	0.210	0.216	0.212	0.209
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes

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