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Abstract

During the COVID-19 crash, U.S. stocks with higher institutional ownership performed worse. This under-performance was unrelated to revisions in earnings expectations, which suggests a disconnect between stock prices and firm fundamentals. Two mechanisms were at play: Institutions faced a sudden increase in redemptions and simultaneously attempted to de-risk their portfolios. Most types of institutional investors re-balanced portfolios toward financially strong firms, whereas hedge funds sold stocks indiscriminately. At least some retail investors (e.g., Robinhood investors) appear to have provided liquidity. Overall, the results suggest that when a tail risk realizes, institutional investors amplify price crashes.

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

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1 Introduction

In normal times, the presence of institutional investors positively contributes to stock market efficiency and corporate value creation.[1] But what is their role during crisis periods? In principle, the professional investment approach of institutional investors could help stabilize markets.[2] However, Stein (2009) points out that when institutions enter the same trades and deleverage at the same time, they could exacerbate stock market crashes.[3]

In this paper, we use the novel coronavirus (COVID-19) pandemic to study how institutional investors react to a tail risk event. The COVID-19 pandemic was a globally disruptive natural disaster that did not originate from changes in underlying economic conditions and investor behavior. The 2008-09 Global Financial Crisis (GFC), for instance, is less suitable to study whether institutional investors stabilize markets or amplify stock price crashes during crises. After all, the GFC developed endogenously over time from within the financial system, giving institutional investors time to reposition their portfolios.

While average institutional ownership (IO) is high on average -- around 80% in the average US firm -- we exploit the substantial cross-sectional variation in IO, and heterogeneity in institutional investor types (in particular hedge funds versus other investors). We find that the prices of U.S. stocks with higher IO dropped more in the historic market correction in the first quarter of 2020. A battery of tests suggests that institutional investors engaged

[1]Prior literature has shown that institutional investors increase price efficiency (Boehmer and Kelley, 2009; Bai, Philippon, and Savov, 2016), facilitate the incorporation of future corporate news into prices (Campbell, Ramadorai, and Schwartz, 2009; Hendershott, Livdan, and Schürhoff, 2015), and improve corporate governance (e.g., Shleifer and Vishny (1986), Dasgupta, Fos, and Sautner, 2021).

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

[3]For example, Dennis and Strickland (2002) find excessive herding by institutional investors on days with large market moves. The deleveraging by hedge funds came under scrutiny in both the Dot-Com bubble (Brunnermeier and Nagel, 2004) and the Global Financial Crisis (Ben-David, Franzoni, and Moussawi, 2012).

in ''fire sales'' of their equity holdings, driven by a sudden increase in redemptions and by institutions' attempts to make their portfolio more COVID-resilient.[4]

Figure 1 about here

Our baseline result is displayed in Figure 1, which shows that for U.S. non-financial Russell 3000 firms the stock price performance during the *Fever* period (Ramelli and Wagner, 2020) -- from February 24 through March 20, 2020 -- is negatively related to the firm's end-of-2019 IO ratio, while controlling for firm and industry characteristics.[5] A one standard deviation higher end-of-2019 IO ratio corresponds to one-tenth lower standard deviation in cumulative *Fever* returns, a sizable effect, considering prior findings of the literature for such key variables such as leverage. In Section 3 we show that such a strong negative relation has been very rarely observed in the last 20 years.

The exogenous and unanticipated nature of COVID-19 makes it a natural candidate for identifying the price effect of institutional ownership.[6] However, this analysis still requires that institutional investors were not ex ante positioned into particularly affected stocks. While it is difficult to definitely rule out this possibility, there is no evidence that this requirement is violated. First, few firms had ex-ante identified pandemics as a material risk (Loughran and McDonald, 2020). Second, we show that pre-pandemic levels of institutional ownership

[4]While there is no universally accepted definition of what constitutes a fire sale, such a situation typically occurs when a fundamental shock (in this case, COVID-19 exposure) triggers asset sales at a discount. This, in turn, generates sales by other institutions that have similar stock exposures and are forced to de-risk their portfolios, potentially further enhanced by capital withdrawals (Shleifer and Vishny, 2011).

[5]This negative association between IO and stock returns during the *Fever* period also holds for global stocks. See Internet Appendix Figure OA1 where we document a similar pattern for non-US stocks in the MSCI ACWI index.

[6]Generally, this identification is challenging as stock returns and IO are jointly co-determined. In this sense, our paper shares the spirit of the demand-system based asset pricing approach proposed by Koijen and Yogo (2019). They address the endogeneity of investor demand and asset prices through instrumental variables. We tackle this issue by studying the behavior of institutional investors after an exogenous shock.

are not correlated with revisions in earnings expectations when COVID-19 hit. Third, the negative association between stock returns and IO holds even controlling for changes in analyst earnings forecasts. We conclude that stocks held more by institutions experienced a larger wedge between stock price changes and revisions in earnings fundamentals.

This evidence suggests that institutions engaged in fire sales and amplified the COVID-19 stock market crash. To study the mechanisms behind the fire sale, we exploit heterogeneity among institutions. We find part of the effects is driven by institutions facing a sudden increase in redemptions and by the simultaneous attempt of institutions to shift their equity portfolios towards more COVID-resilient firms.

Specifically, we find that the negative relation between IO and stock performance in the *Fever* period is more pronounced for stocks held by institutions that had higher capital withdrawals in the first quarter of 2020. This suggests that some of the portfolio managers' decisions to sell were due to forced liquidations of holdings unrelated to firm.

Moreover, the composition of a stock's institutional investors' portfolios impacted that stock's fragility. Firms with low cash and high leverage experienced greater declines when these were held by institutional investors with portfolios heavily exposed to *other* firms with weak corporate financials. Prior work has identified low cash and high leverage as indicators of low COVID-19-resilience (Ramelli and Wagner, 2020; Fahlenbrach, Rageth, and Stulz, 2021). Our findings clarify that the value-relevance of these factors depended on the shareholders' exposure to financial risks elsewhere on their equity portfolio.[7] In a standard firm valuation setting, the stock price would only reflect the firms' own fundamentals. Instead, we find

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

that prices were affected by spillover effects from the institutions' other portfolio holdings, consistent with fire sales across equities.

Changes in IO in the first quarter of 2020 provide additional support that institutions simultaneously de-risked their equity portfolios. These changes indicate an unusual institutional selling activity triggered by the pandemic outbreak. Studying the cross-section of changes sheds light on the channels. First, if institutions are the driving force behind the stock price drops, we should observe that the stocks with more negative returns experienced a stronger decrease in IO in 2020-Q1.[8] This is what we find. Second, the portfolio reshuffling by institutions was geared towards financially stronger firms. Results show 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 changes associated with these corporate characteristics. When we decompose IO, we find that certain types of institutional investors sold stocks independent of the companies' financial strength, presumably in an attempt to deleverage. Hedge funds sold more than 4% of their aggregate equity portfolio in the first quarter of 2020 (over USD 100 billion).[9] Overall, we conclude that, during the COVID-19 crash, institutional investors in the aggregate sold equity positions and investors other than hedge funds expressed a strong appetite for financially strong companies.

The aggregate selling by institutions implies that other groups of investors took the opposite side of those trades, possibly mitigating larger fire sales externalities. Individual investors are the most likely candidates, given that their ownership is often approximated as

[8]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 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).

[9]Schrimpf, Shin, and Sushko (2020) show that hedge funds sold even high-quality Treasury bonds.

100% minus IO (e.g., Koijen, Richmond, and Yogo, 2020). In one particular sample, concrete evidence on whether individual investors in fact provided liquidity to stocks that institutions exited is available. Specifically, we study the changes in popularity of stocks on the retail trading platform Robinhood Markets Inc. (RH). We find that the change in the number of RH investors in individual stocks over the first quarter of 2020 exhibited opposite patterns to the changes in IO. In particular, in March 2020, retail interest increased substantially for stocks with high leverage and low cash holdings.[10]

Finally, a test of fire sales is to ask whether institutional investors reverted their trades in the second quarter of 2020? We find no reversal in institutions' risk-averse strategies, despite the injection of liquidity by the Fed and the aggregate market rally. Institutions continued tilting their portfolios towards firms that entered the pandemic with strong financials. We interpret this result as a signal of the still elevated concerns by institutional investors with respect to economic growth and excess corporate debt. Robinhood users also continued expressing complementary preferences to their institutional counterparts. We do, however, observe a moderate reversal of the effect of IO on stock returns. Specifically, stocks that had the largest decline in IO in the first quarter experienced higher returns in the second quarter of 2020. This pattern is consistent with other investors picking up undervalued shares as expected following a fire sale (Coval and Stafford, 2007) and was possibly accelerated by the unprecedented interventions by the Fed.

Our paper contributes to the understanding of institutional investors' behavior during

[10]Robinhood investors, also studied in, for example, Ozik, Sadka, and Shen (2021), van der Beck and Jaunin (2021), and Welch (2021), hardly qualify as representative retail investors. For example, they are unusually active, and some investments in unusual stocks stand out. Perhaps it is particularly noteworthy from this perspective that, as evidenced also in Welch (2021), collectively, they did not panic. He notes that the typical RH investments were fairly sane and that the ''crowd consensus portfolio'' did not underperform in the time period of analysis.

crisis episodes. On the one hand, institutional investors are sophisticated investors that can improve stock market efficiency (Sias and Starks, 1997; Boehmer and Kelley, 2009; Campbell, Ramadorai, and Schwartz, 2009; Hendershott, Livdan, and Schürhoff, 2015; Bai, Philippon, and Savov, 2016) and corporate governance (Dasgupta, Fos, and Sautner, 2021). One may expect institutional investors to help stabilize markets after an exogenous catastrophic event, as happened following the 9/11 terrorist attacks (Chen et al., 2019).

On the other hand, institutional investors have been shown to have a tendency to "herd" by trading in the same direction (Nofsinger and Sias, 1999; Sias, 2004; Dasgupta, Prat, and Verardo, 2011; Koch, Ruenzi, and Starks, 2016) and to exert significant downward pressure on prices following sudden increases in redemption risks (Coval and Stafford, 2007).[11] For instance, during the GFC, stocks held by short-term institutional investors and hedge funds performed worse (Cella, Ellul, and Giannetti, 2013; Ben-David, Franzoni, and Moussawi, 2012), and many institutional investors ceased to serve as liquidity providers (Anand et al., 2013; Çötelioğlu, Franzoni, and Plazzi, 2021; Manconi, Massa, and Yasuda, 2012). Ben-David et al. (2021) show that stocks display higher volatility and greater fragility in periods of financial turmoil when institutional ownership is more concentrated among large investors. Weber (2021) shows that the valuation of high-IO firms is more sensitive to changes in time-varying expected returns than the valuation of low-IO firms, due to a higher exposure to liquidity and redemption risks.

What does one learn from this study beyond what research on previous crises (in particular the GFC) has already taught us? First, financial crises, such as the GFC, often emanate

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

directly from within the financial sector and take time to unfold, posing difficult identification challenges in studying the behavior of institutional investors in the face of real shocks. Furthermore, it is unclear ex ante (but important to know) how institutions respond to new crises, given that the regulatory changes in the aftermath of the GFC were targeted at preventing future fire sales externalities by financial market participants. Our paper, by contrast, exploits the scale of the COVID-19 shock and provides novel evidence of the existence and effects of institutional fire sales when an exogenous and sudden disaster strikes.

Second, we also contribute by analyzing the channels, namely, by showing that institutional investors magnified the COVID-19 stock market crash through their concurrent capital withdrawal and portfolio rebalancing towards firms less exposed to the pandemic. Importantly, we are able to show which firm characteristics institutional investors associated with ''quality'' following the realization of a tail risk event. While investors in the GFC primarily sought to avoid exposure to the financial sector, our analysis reveals how firms selected what they considered the most resilient firms *within* each sector. This is consistent with the idea that the COVID-19 crisis, unlike the GFC, had more to do with the reallocation of capital rather than an aggregate decline in the supply of capital (Duchin and Harford, 2021).

Our focus is on institutional investors. Implicitly, the analysis also speaks to the behavior of retail investors, as these are often to be taken the complement. Our analysis of Robinhood (RH) investors provides additional color by providing explicit evidence of one, admittedly specific group counterbalancing the institutions' trading.[12] Welch (2021) also concludes that RH investors were a (small) stabilizing force. Our analysis extends his by explicitly

[12]Other studies have looked at 401(k) plan participants (Blanchett, Finke, and Reuter, 2020), Vanguard clients (Giglio et al., 2020), U.K. retail investors (Ortmann, Pelster, and Wengerek, 2020), controlling family shareholders (Amore, Pelucco, and Quarato, 2020) and insiders (Anginer et al., 2020).

considering how, for example, the financial strength of companies explained RH holdings.[13]

Finally, our research contributes to the literature on the determinants of investor reactions to COVID-19 and the related implications in terms of corporate finance.[14] Falato, Goldstein, and Hortaçsu (2021) and Haddad, Moreira, and Muir (2021) provide evidence of COVID-induced fire-sales externalities in bond markets, consistent with the channels studied in Falato et al. (2019) and Goldstein, Jiang, and Ng (2017). A few other studies have documented the stock-price effects of the level of IO in the COVID-19 crash, without studying the channels through which these effects occurred.[15] Our paper is the first to identify the role of fire sales in equity markets by analyzing actual portfolio changes of institutional investors.

2 Data

Our main sample consists of non-financial constituents of the Russell 3000 index as of the end of 2019-Q4.[16] Table A1 in the Appendix provides detailed variable definitions.

[13]These results are in line with prior empirical and newer theoretical literature. For example, Barrot, Kaniel, and Sraer (2016), for instance, show that individual investors provide liquidity to the stock market during times of market stress (and are compensated for doing so). In the model of Hendershott et al. (2021), more frequent rebalancing needs of institutional investors during market-downturns generate price overshooting, with retail investors providing liquidity.

[14]Early studies on US stock price reactions include (in alphabetic order) Albuquerque et al. (2020), Alfaro et al. (2020), Gormsen and Koijen (2020), Landier and Thesmar (2020), Pagano, Wagner, and Zechner (2020), and Ramelli and Wagner (2020). Early international studies include Ding et al. (2021), Gerding, Martin, and Nagler (2020), and Ru, Yang, and Zou (2020).

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

[16]All main results hold when including financial stocks as well. However, given that in some of our analyses firm-level leverage plays an important role, we opt to exclude financial companies for the main analysis.

2.1 Institutional and retail investor data

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

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

We also calculate other portfolio-level investor characteristics to test the ''fire sales" channels. *LowFlowsInGFC IO* is the level of ownership by institutional investors who experienced investor flows in the bottom tercile (that is, the highest outflows) during the GFC.[19] *LowFlowsIn2020Q1 IO* is the level of ownership by institutional investors

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

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

[19]We calculate *LowFlowsInGFC IO* in two steps. First, we compute flows during the GFC for each institutional investor as the change in total disclosed equity assets between December 2007 and June 2009

who experienced investor flows in the bottom tercile during the first quarter of 2020.[20] *HighLeverage IO* and *LowCash IO* are the levels of ownership by institutional investors with above-median portfolio exposure to *Leverage* and below-median portfolio exposure to *Cash/assets*, respectively.[21]

Our main focus is on institutional investors, but we also consider the trading behavior of a specific group of retail investors for which data are available 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 at least some insights into retail investor behavior.

Specifically, 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.[22] Robinhood investors tend to be young (median age of 30) and have between US$ 1,000-5,000 in their brokerage account. Individuals trading on this platform are

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 1st and 99th percentiles. Second, we construct a stock-level variable that gives the percentage of outstanding shares held by institutional investors with below- or above-median flows during the GFC.

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

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

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

not fully representative of the trading behavior of all US retail investors (as also discussed in Barber et al., 2021). Moreover, some of them choose some rather obscure ''experience'' stocks. However, the overall ''crowd consensus'' portfolio was not overly tilted to these unusual stocks Welch, 2021. Also, Robinhood investors still constitute a sizable sample of active individual investors. Data on the amounts invested in individual stocks are not available but RH provided data on the number of accounts that held a given stock in real-time.[23] We compute the variable *%Δ log(RHusers) 2020Q1* as the percentage change of log Robinhood users invested in a given stock between December 31, 2019, and March 31, 2020. In additional analysis, we also consider the daily changes in RH users.

2.2 Stock returns, analyst forecasts, and firm characteristics

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

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

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

market factor.[25] *Stock illiquidity* is the Amihud illiquidity measure computed as the daily ratio of the absolute value of the return to the dollar volume (in million), averaged over all trading days in 2019.

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

We obtain information on firms' environmental and social (ES) performance from two distinct sources. First, we employ MSCI's Intangible Value Assessment (IVA) database, which has been used in several academic studies (e.g., Liang and Renneboog, 2017). We define the variable *ES (msci)* as the average of the MSCI IVA's scores on the environmental 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 (ASSET4), used

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

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

by Albuquerque et al. (2020).

2.3 Descriptive statistics

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

Table 1 about here

3 Stock prices and institutional ownership

3.1 Main effects of institutional ownership

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

The regression results in column (1) in Table 2 show that firms with higher institutional ownership at the end of the year 2019 experienced worse stock price drops during the COVID-19 crash.[27] Economically, a one standard deviation higher IO_{2019Q4} corresponds to one-tenth

[27]In addition to controlling for industry fixed effects, we also ensure that all our findings remain qualitatively

lower standard deviation in cumulative *Fever* returns. This effect is sizable and quite similar in magnitude to the effects of one standard deviation differences in *Cash/assets* and *Leverage*, two features that prior literature has identified as key drivers of stock price performance in the COVID-19 crisis. As Figure 1 indicates, in the early phases of the outbreak (even after human-to-human transmission of the novel coronavirus was confirmed on January 22, 2020), IO was not significantly associated with stock returns. A large part of the effect of IO comes from the last week of the *Fever* period, after the World Health Organization had characterized COVID-19 as a pandemic on March 11 (`https://ourworldindata.org/coronavirus`). Stock prices experienced a dramatic decline in that phase.

Table 2 about here

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

unchanged when excluding the energy (GICS sector = 10) and IT stocks (GICS sector = 45) from the sample, i.e., the industries that fared worst and best during the COVID crash.

[28]Our results remain unchanged also when controlling for a stock's liquidity risk exposure (also known as liquidity beta), computed by regressing daily stock returns in 2019 on the Fama-French factors and the

the regression. Consistent with Albuquerque et al. (2020), firms with higher *ES score (msci)* had a higher stock performance during the *Fever* period.[29] Despite the smaller sample size, the impact of IO is unaffected by controlling for ES scores.

Is the negative stock-price effect of IO specific to times of financial turmoil like the ''Fever'' period in the COVID-19 crisis? Or is it perhaps a more general feature of the cross-section of stock returns? The extant literature suggests that, if anything, the general relation between IO and stock returns should be positive, not negative. For example, Gompers and Metrick (2001) show that higher levels of institutional ownership forecast higher stock returns, either because institutions self-select into stocks with stronger future performance or because of the price pressure they exert on assets they buy. Yan and Zhang (2009) add that the positive relation between institutional ownership and future returns is driven by some institutional investors' informational advantage.

These results from older samples hold even when considering a more recent period. Panel A of Figure 2 shows through a binned scatter plot the estimated effect of previous-quarter IO on monthly returns over the period ranging from April 2000 through December 2019, net of other firm characteristics and month fixed effects. As expected, on average, the historical relation between IO and stock returns is positive, and not negative as in the Fever period.

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

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

Specifically, a regression of monthly returns on previous-quarter IO and the same control variables as in column (1) of Table 2, using the 20 years period, yields a coefficient of 0.001 on IO.[30]

This historical analysis is also useful to further support the reliability of the inferences regarding the effect of IO during COVID-19. Specifically, one potential concern is that the analysis in Table 2 relies on one cross-sectional regression, which does not allow one to control for the potential cross-sectional correlation of stock returns (Fama and MacBeth, 1973; Fama and French, 1992). Cohn, Gillan, and Hartzell (2016) propose a method to address this problem by using the empirical distribution of coefficient estimates (mean and standard deviation) derived from similar regressions in the past. Following their approach, we adjust the t-statistics from our main regressions in Table 2. Using this method, we obtain a t-statistic on the IO coefficient equal to -3.04, compared to the conventional t-statistic of -2.92 reported in column (1).[31]

The average slightly positive effect could mask the existence of a large number of time periods with highly positive and highly negative relations between stock returns and IO. Thus, the view of the overall period does not preclude the possibility that the COVID-19 findings are just one of many instances where stocks with high IO performed poorly. To further examine the uniqueness of the COVID-19 episode, we run 1,054 cross-sectional regressions of weekly stock returns on prior-quarter IO from April 2000 through March 2020, controlling

[30]When double-clustering standard errors both at the firm-month level (Petersen, 2009), this coefficient on IO is not statistically significant ($p > .734$).

[31]Specifically, following Cohn, Gillan, and Hartzell (2016), we first run a set of 236 cross-sectional regressions of monthly returns from April 2000 through December 2019 (non-event period) on lagged IO and firm characteristics. The adjusted t-statistic is then computed as our estimated IO coefficient over the Fever period (-0.069, see Table 2 column (1)) minus the average time-series IO coefficients over the non-event period (.0006), divided by the standard deviation of the coefficients over the non-event period (0.0229).

for the effects of the same firm characteristics as in Table 2. Panel B of Figure 2 plots the IO coefficients estimated from these regressions over time. Before the last week of the Fever period, IO had a strong negative effect on stock prices only in two other instances: in October 2008 (GFC) and in January 2001 (Dot-com bubble burst).

Figure 2 about here

We next examine the role of investor heterogeneity in terms of activeness, horizon, and domicile. Column (3) of Table 2 indicates that a higher percentage of $PassiveIO_{2019Q4}$ is associated with more resilience.[32] 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 the work by Cella, Ellul, and Giannetti (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, Kho, and Stulz (1999), who show that foreign investors do not destabilize markets, and with Kacperczyk, Sundaresan, and Wang (2018), who show that foreign ownership increases market liquidity. Ferreira, Massa, and Matos (2018) also suggest that foreign investors can provide a benefit as they have fewer outflows during market downturns.

Overall, these tests show that higher institutional ownership before the crisis was negatively associated with stock price performance during the COVID-19 crash. The finding that this relation is particularly pronounced when there are more active and more short-term investors

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

suggests that the price changes were caused by trades of actively managed institutional portfolios. We conduct more specific tests regarding potential institutional fire sales in the next section.

3.2 Evidence on institutional fire sales

Why is institutional ownership a key explanatory variable for stock returns in the COVID-19 crash? A possible interpretation is that the stock price drop in the *Fever* period was partially driven by institutional owners in what amounts to a "fire sale" (Coval and Stafford, 2007; Shleifer and Vishny, 2011). Conceptually, two factors are likely to have contributed to institutional fire sale externalities: 1) the sudden increase in redemption risks, urging institutional investors to decrease the total size of their equity exposure, and 2) an attempt of institutional investors to de-risk their portfolios by rebalancing towards firms better prepared to deal with the effects of the pandemic. DeVault, Sias, and Starks (2019) denote these two drivers as flow-induced institutional demand shocks and institutional managers' decisions, respectively.

Panel A of Table 3 shows that both factors seem to have played a role. Related to the first factor, column (1) indicates that stocks with higher ownership by investors with higher client outflows during the GFC ($LowFlowsInGFC\ IO_{2019Q4}$) performed worse. Presumably, these investors, more than 10 years after the GFC, were again facing the risk of having to respond to massive redemptions of their clients in response to COVID-19, and acted accordingly.[33] While outflows during the GFC have the advantage that they are predetermined to the

[33]Additionally, a more negative experience during the GFC may have increased the risk sensitivity of institutional investors, and hence their reaction to the pandemic. On the links between experience and institutional investors' beliefs see Chernenko, Hanson, and Sunderam (2016).

pandemic, it is also interesting to consider contemporaneous investor withdrawals. Column (2) shows that stocks performed worse when they were held more by institutional investors that experienced large outflows during 2020-Q1. These findings suggest forced sales to meet liquidity demands (Coval and Stafford, 2007).

Related to the second factor, columns (3) to (6) show that higher ownership by institutional investors with above-median portfolio exposure to high-leverage ($HighLeverageIO_{2019Q4}$) and to low-cash firms ($LowCashIO_{2019Q4}$) is associated with a significant *amplification* of the stock price effects of firms' financial strength.[34] While prior literature has identified financial strength as a major determinant of firms' cash-flow prospects during crises (including during COVID-19), our finding indicates that the financial exposure of institutional investors themselves can create spillover effects on their portfolio companies. Thus, while prior work has highlighted that on average there was a stock price penalty associated with financial weakness, our results suggest that the effect is concentrated among those firms that, besides weak finances, also have institutional investors that are strongly exposed to such type of companies in their portfolios. These results suggest that in this crisis period stock prices were not determined exclusively by an assessment of fundamental values but also by mere ownership links, a feature of a fire sale.

To further examine the idea of a disconnect between stock prices and fundamentals, we employ a proxy for changes in fundamental values: analyst earnings forecast revisions. This

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

proxy allows us to examine whether institutional trades are aligned with firm fundamentals, and whether the relation between stock prices during the crisis and institutional ownership at the end of 2019 is merely a reflection of institutions being systematically positioned in firms that were ultimately hit harder by the crisis. In Panel B of Table 3, we show that, as expected, stock returns and revisions in mean analysts' earnings forecasts are closely aligned.[35] However, importantly, our results on the effect of IO during the *Fever* period hold even when controlling for earnings forecast revisions. Thus, to the extent that earnings forecast revisions are unbiased, these findings indicate that firms with higher institutional ownership saw a larger wedge between stock prices and earnings fundamentals. Consistent with this, Figure 3 shows that there is no correlation between IO at Q4-2019 and analyst revisions during 2020-Q1 of EPS for 2021, suggesting that firms with high IO were not hit harder by the pandemic.[36]

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

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

[36]Further results (not shown, but available upon request) show that a similar pattern holds for other analyst forecast horizons.

4 Changes in total institutional ownership

This section examines more directly whether institutional owners amplified negative stock moves by studying ownership changes in the first quarter of 2020. To provide some descriptive background, Figure 4 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.[37]

Figure 4 about here

4.1 What explains institutional ownership changes?

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

Table 4 about here

First, in columns (1) and (2) of Table 4, we observe that in in 2020-Q1 IO *changes* more negatively in firms that experienced worse stock price performance in the *Fever* period

[37]Internet Appendix Figure OA2 shows the distributions of the IO changes in each of the four quarters of 2019 are also symmetric as in 2019-Q4. Internet 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.

strongly. (Notice that whereas in Table 2 we looked at the relation between the stock returns in Fever and the level of IO *before* the pandemic, here we are interested in changes in IO during 2020-Q1.) This confirms that the price penalty associated with IO is driven by the active trading activity of institutional owners (rather than the alternative that other groups of investors sold particularly aggressively in firms with large institutional ownership).

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

In column (5), we add firms' ES scores (*ES score (msci)*). The statistical significance of the coefficients on *Leverage* and *Cash/assets* is reduced due to the smaller sample size. We find no evidence that institutional investors have tilted their portfolios toward firms with higher environmental and social performance. Presumably, the stock-price premium associated with the ES score during the COVID-19 crash is not driven by a demand pressure coming from institutional investors. These results suggest that institutional investors, at least in times of crisis, prefer hard resilience characteristics over soft firm attributes. [38]

[38]In results available upon request, we obtain similar inferences when employing the ES scores from Thomson Reuters Refinitiv. While not our main focus, these results on ES are interesting in light of some contemporaneous work showing that firms with stronger ES performance did better in the crisis (Albuquerque et al., 2020; Garel and Petit-Romec, 2021), though this result has been the subject of some debate (Demers et al., 2021; Mahmoud and Meyer, 2020). For mutual funds, too, the findings are partially contradictory (Pástor and Vorsatz, 2020; Döttling and Kim, 2022).

Panel B of Figure 4 illustrates these results, plotting the relation between the net change in institutional ownership in 2020-Q1 and firm leverage, cash holdings, and environmental and social (ES) scores.[39] In sum, institutional investors reacted to COVID-19 by significantly pulling out from corporations with ex-ante weak financials.

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 combined result of both endogenous decisions by corporations and institutional investors' portfolio choices.[40] Since COVID-19 is an exogenous shock it offers an opportunity to exploit the portfolio reshuffling by institutional investors to infer their revealed preferences for firm characteristics.

4.2 Placebo tests

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

First, in Panel A of Table OA1, we re-estimate the regressions in Table 4 using only the subsample of S&P 500 constituents as of January 2020. Since the S&P 500 is a popular index

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

[40]Grennan, Michaely, and Vincent (2017) empirically investigate the links between institutional ownership and capital structure decisions.

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

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

4.3 Portfolio changes by investor category

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

We first compute how the total equity position of each type of investors changed in

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

Illustrating the change in equity positions, Figure 7 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.[41] Hedge funds divested significantly more in absolute and relative numbers than pension funds, mutual funds, or investment advisors.

Figure 7 about here

In Table 5 we study the determinants of the change in stock ownership by investor category. Column (1) shows that hedge funds appear to have deleveraged by selling stocks that performed relatively well during the Covid crash. These investors did not undertake a significant portfolio re-balancing towards financially stronger firms (see Columns (2) and (3)). Presumably, they decreased their portfolio leverage by trying to sell ''everything'' in their

[41]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).

portfolios, perhaps even starting from the most easy-to-sell stocks. By contrast, Columns (4) to (6) show that institutional investors other than hedge funds appear to have discriminated between firms on the basis of their financial positioning, in line with the results in Table 4. Notably, once we separate out hedge funds, leverage is a significant determinant of IO changes again, even in the smaller sample where we have ES data.

Table 5 about here

If institutions behaved (in aggregate) as net sellers, especially for more financially fragile stocks, which market participants took the other side of their trades? Did individual investors act as liquidity providers, hence revealing heterogeneous preferences from their institutional counterparts? Columns (7) to (9) in Table 5 investigate the cross-sectional effects of firm characteristics on the percentage change in (the log of) Robinhood users in 2020-Q1 on firm characteristics. Effectively showing the flip side of the behavior of institutional investors, Robinhood investors bought high-leverage and low-cash firms and invested particularly in firms that experienced worse stock performance.[42] From column (8), a one standard deviation higher leverage led to a 6% of a standard deviation higher increase in popularity among Robinhood investors (-0.041 $\times$ 22.7/15.14).

Panel A of Figure 5 shows that there is a strong negative correlation between the change in IO in a stock and the change in Robinhood 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,

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

institutional investors reduced holdings the most in those industries which were most favored by Robinhood investors. Overall, these results are in line with Barrot, Kaniel, and Sraer (2016), who find that retail investors provide liquidity when institutional liquidity providers are constrained.

Figure 5 about here

Figure 6 shows the day-to-day evolution of Robinhood investor interest in cash, leverage, and ES performance during 2020-Q1. Using the granularity of the Robinhood data, we rerun our baseline regressions in Panel B of Table 4 for each day using the year-to-date percentage change in Robinhood users. We notice that Robinhood users show an increasing interest for low-cash and high-leverage firms after March 11, 2020. These changes in Robinhood investor interest align with the institutional-related stock price drop shown in Figure 1, which provides further evidence that Robinhood investors moved into the high-leverage and low-cash stocks that institutional investors were selling during the *Fever* period.[43]

Figure 6 about here

5 Did investors reverse their trading in Q2-2020?

The main focus of this paper is to analyze the investor behavior during the first quarter of 2020, when the COVID-19 shock caused extreme uncertainty in financial markets. What happened beyond the initial crisis phase is also of interest, however, as it may reveal something

[43]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, Naughton, and Wang (2020) find (for the pre-COVID period) that Robinhood traders actually do not respond to ESG disclosures.

about the mechanisms behind the effects observed in the crisis. In particular, a classic feature of a fire sale is the reversal of trading decisions after the crisis (Coval and Stafford, 2007).

The analysis of investor behavior over the second quarter of 2020 has to take into account that the Fed's announced massive interventions on March 23 and significantly expanded those interventions on April 9. The Fed's promise of massive injection of liquidity (D'Amico, Kurakula, and Lee, 2020; Haddad, Moreira, and Muir, 2021) reassured investors and paved the way for a swift reversal of major stock indexes. The second quarter of 2020 was regarded in the financial press as a period of overall stock market exuberance, but individual companies fared unequally.[44] 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.

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

How should we interpret the portfolio reshuffling in 2020-Q2? If the market performance in 2020-Q2 was indeed the start of a ''recovery phase'', i.e., a comeback of corporate valuations

[44]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)).

to their pre-crisis levels, we would expect firms that lost most IO in the first quarter to be those that saw it increase the most during the second quarter. In other words, we would expect institutional investors to reverse the divestment they made in 2020-Q1.

The data, however, seem to indicate the opposite. Panel A of Figure 8 displays a positive correlation between IO changes in 2020-Q1 and 2020-Q2, suggesting that institutional investors kept buying the same stocks in 2020-Q2 as in 2020-Q1 (albeit in a less pronounced fashion). Consistent with this, Table 6 and Internet Appendix Figure OA6 document that institutional investors in 2020-Q2 continued shifting their portfolios towards high-cash and low-debt firms. Robinhood users kept expressing complementary preferences to their institutional counterparts in 2020-Q2.[45]

Figure 8 about here

Table 6 about here

Nevertheless, we find some evidence of stock price reversals in 2020-Q2. Panel B of Figure 8 shows that firms that saw a larger decline in IO during 2020-Q1 (a more negative Δ IO 2020Q1) did experience some stock price reversal during 2020-Q2, net of the effect of other firm characteristics. This reversal could be consistent with a correction of potential 2020-Q1 fire sales externalities. The positive abnormal returns in 2020-Q2 would compensate those who provided liquidity in the crisis period. This could have been driven in particular by individual investors given that we find no evidence that institutional investors bought back the stocks that they sold earlier. The targeted initiatives deployed by the Fed to support

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

the credit markets (illustrated with the red bars) may have further accelerated this return reversal pattern.

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

6 Conclusion

The long-term impact of negative economic shocks on corporations depends on the behavior of their shareholder base. Given that the majority of US shares are nowadays held by institutional money managers it is essential to understand the role of these investors when a disaster strikes.

We show that after the outbreak of COVID-19, the combination of institutional equity sales to meet redemptions and an institutional preference for financially strong firms contributed to fire sales externalities. These amplified the stock price drops beyond just the losses from the deterioration of the fundamental outlook for many firms. Institutional investors' quarterly portfolio changes in the first quarter of 2020 confirm that this set of market participants were the marginal investors driving prices in the COVID-19 crash.

Institutions sought firms that had financial strength (high cash and low leverage) to insure their portfolios against the indeterminate duration of the cash-flow shortfall. The

one exception were hedge funds, which engaged in a deleveraging of their equity positions without discriminating by the financial strength of the underlying companies. By contrast, at least the group of retail investors for whom we have data, namely, Robinhood investors, increased their interest in financially more fragile firms and industries hit harder by the pandemic, hence providing liquidity and revealing more risk appetite than their institutional counterparts in times of crisis.

The result that when a tail risk realizes, institutional investors amplify price crashes by fire-selling has important implications. First, it highlights to regulators the potentially problematic role of institutional investors (especially short-term ones) for macro-financial stability. Second, it indicates that, even in ''normal'' times, companies should be mindful of their shareholder base and the behavior of their marginal investors when disasters strike.[46]

While we have focused on documenting the evidence of institutional fire sales during COVID-19, future research may use our findings as a starting point to shed more light on at least two other important questions. First, the crisis offers an opportunity to study the role played by specific investor characteristics like experience (e.g., Chernenko, Hanson, and Sunderam, 2016). Second, research is needed to illuminate the real effects of fire-sales-driven mispricing on corporate decisions (in the spirit of Khan, Kogan, and Serafeim, 2012 and Hau and Lai, 2013).

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

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Figures

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.

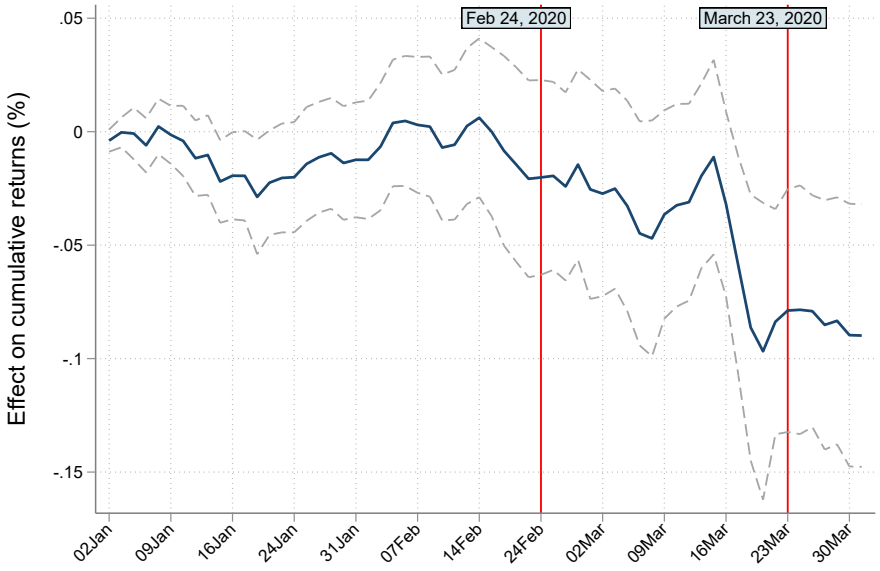


Figure 2: Historical perspective on the relation between institutional ownership (IO) and stock returns

Panel A shows through a binned scatter plot the relation between monthly returns from April 2000 through December 2019 and previous-quarter IO, controlling for firm characteristics (Cash/assets, Leverage, Market beta, Stock illiquidity, log(Market cap), Profitability, and Book-to-market) and industry and month fixed effects. Panel B shows the evolution of the coefficients on IO in 1,054 cross-sectional regressions of weekly returns from April 2000 through March 2020. 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 sample includes non-financial firms covered by Compustat with available historical IO information.

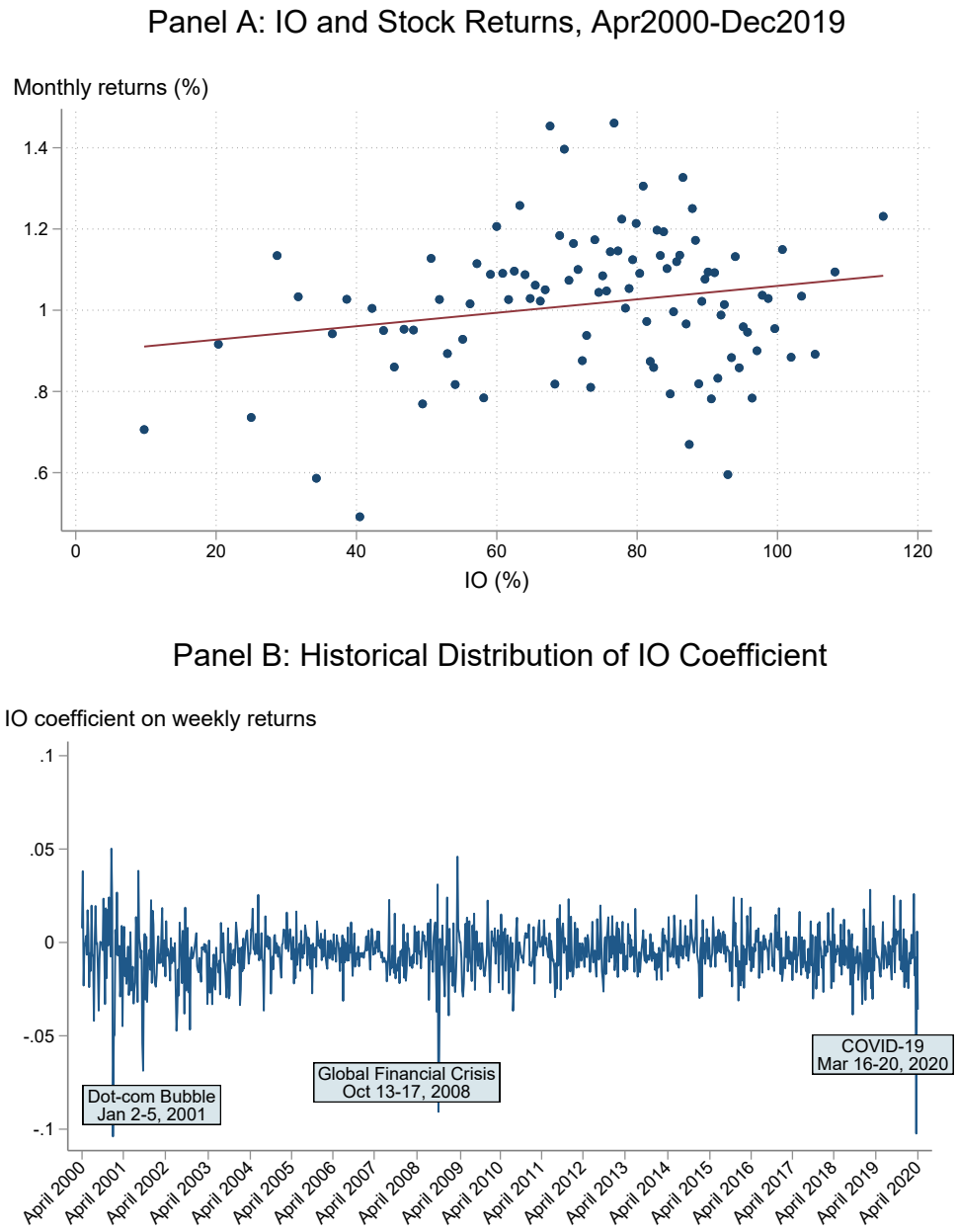


Figure 3: Relation between institutional ownership (IO) and revisions of EPS forecasts

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

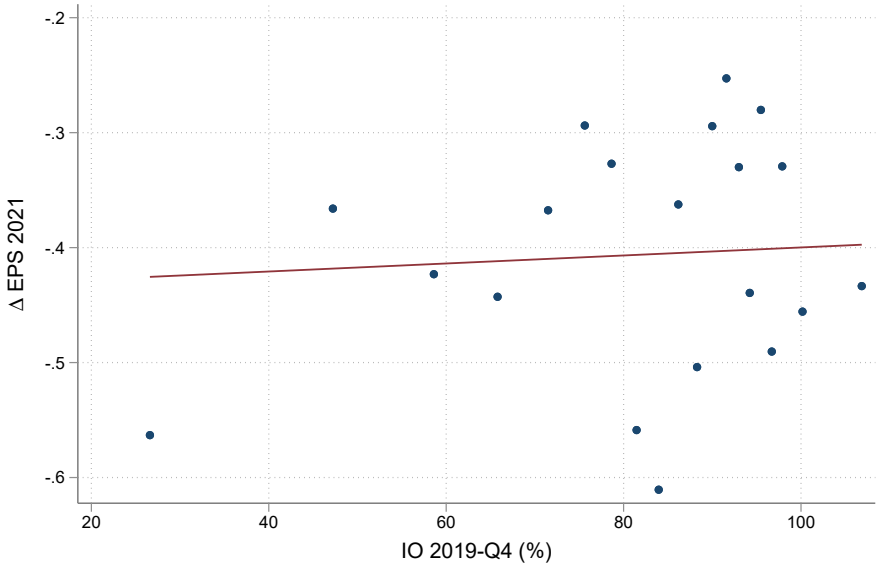


Figure 4: Change in institutional ownership (IO) and firm characteristics in 2020-Q1

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.

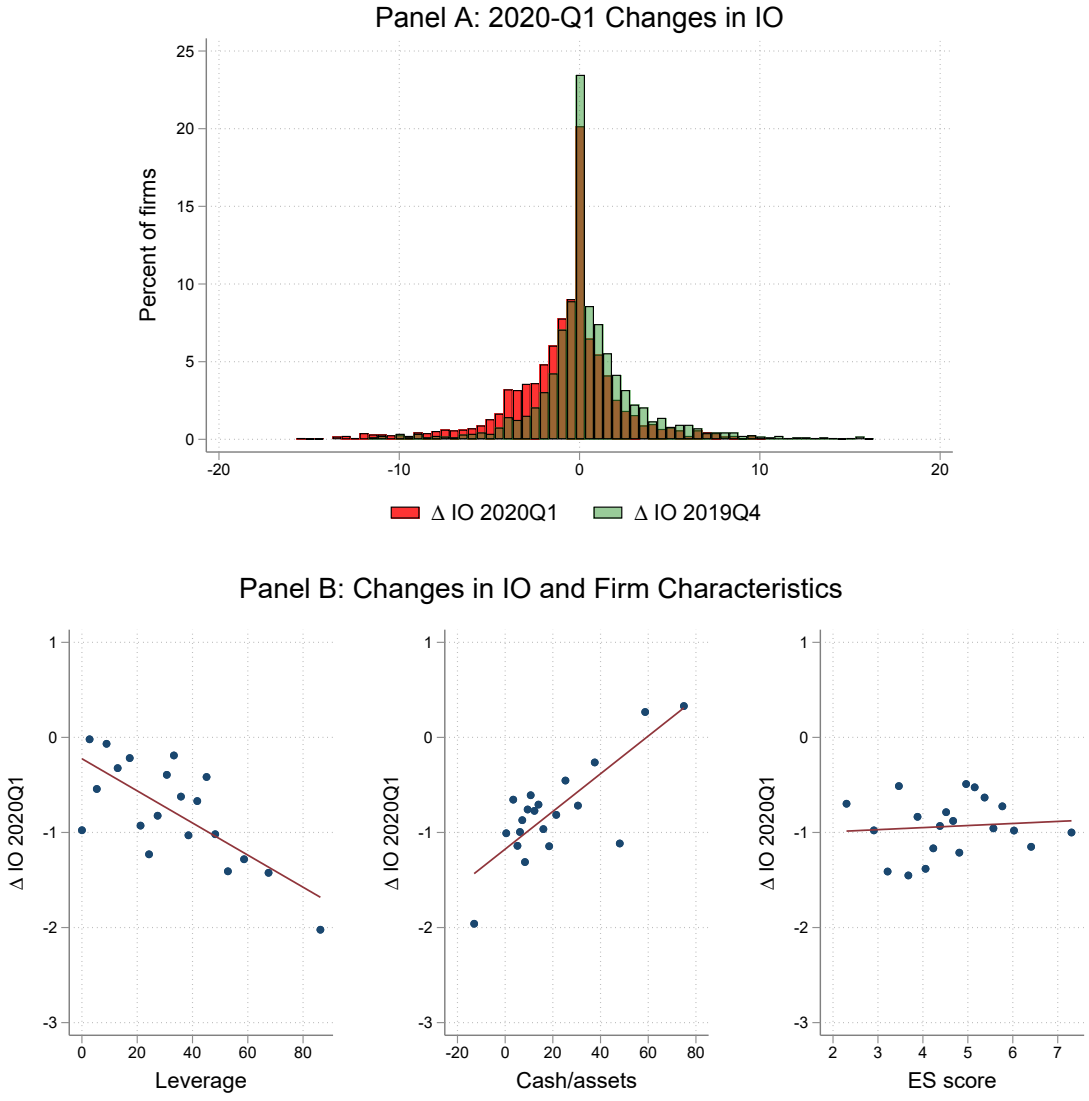


Figure 5: Change in Robinhood investor popularity against the change in institutional ownership (IO)

Panel A shows a binned scatter plot of the percentage change in the popularity of a stock with Robinhood investors (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.

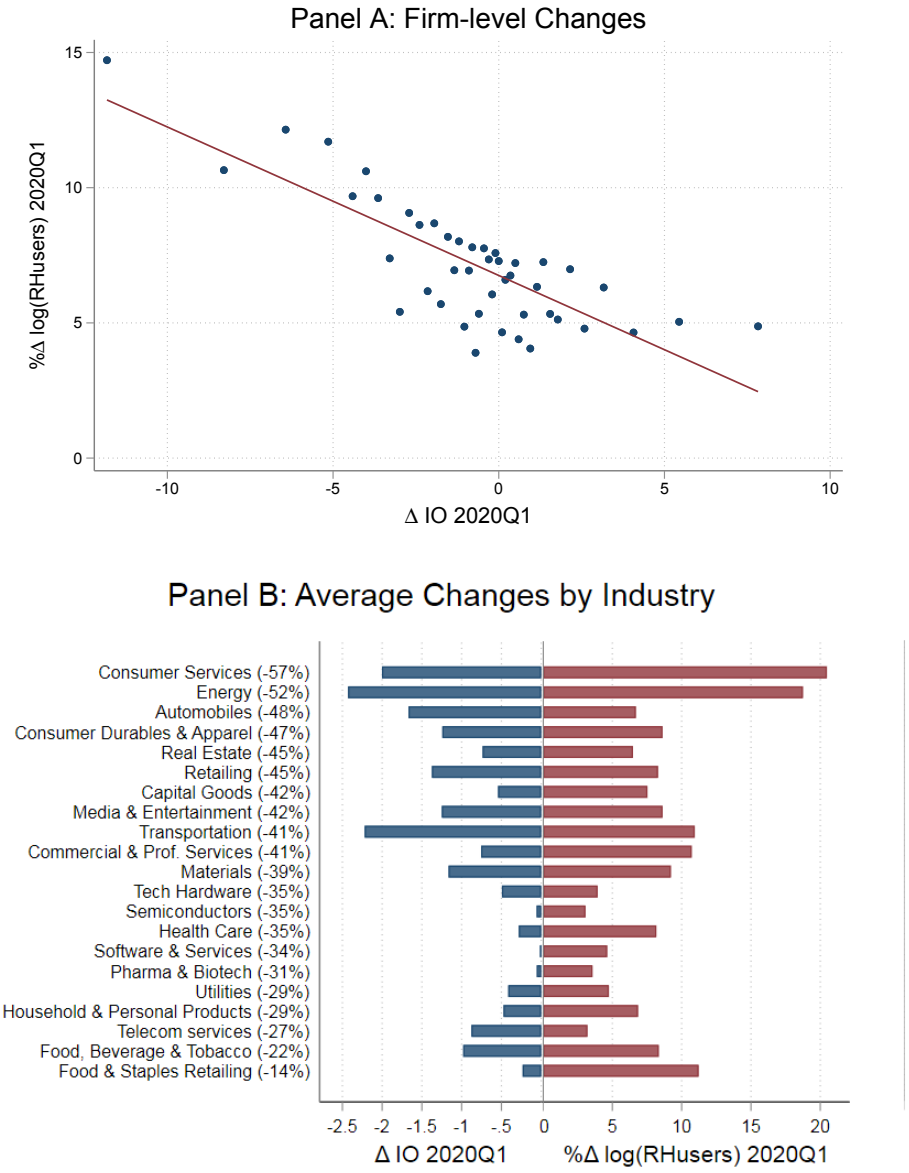


Figure 6: Robinhood investor interest and firm characteristics
These graphs show the day-to-day evolution of Robinhood investor interest in cash, leverage, and ES performance. Each point is the coefficient on either Cash/assets, Leverage, or ES (msci) from OLS regressions of the percentage change in 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.

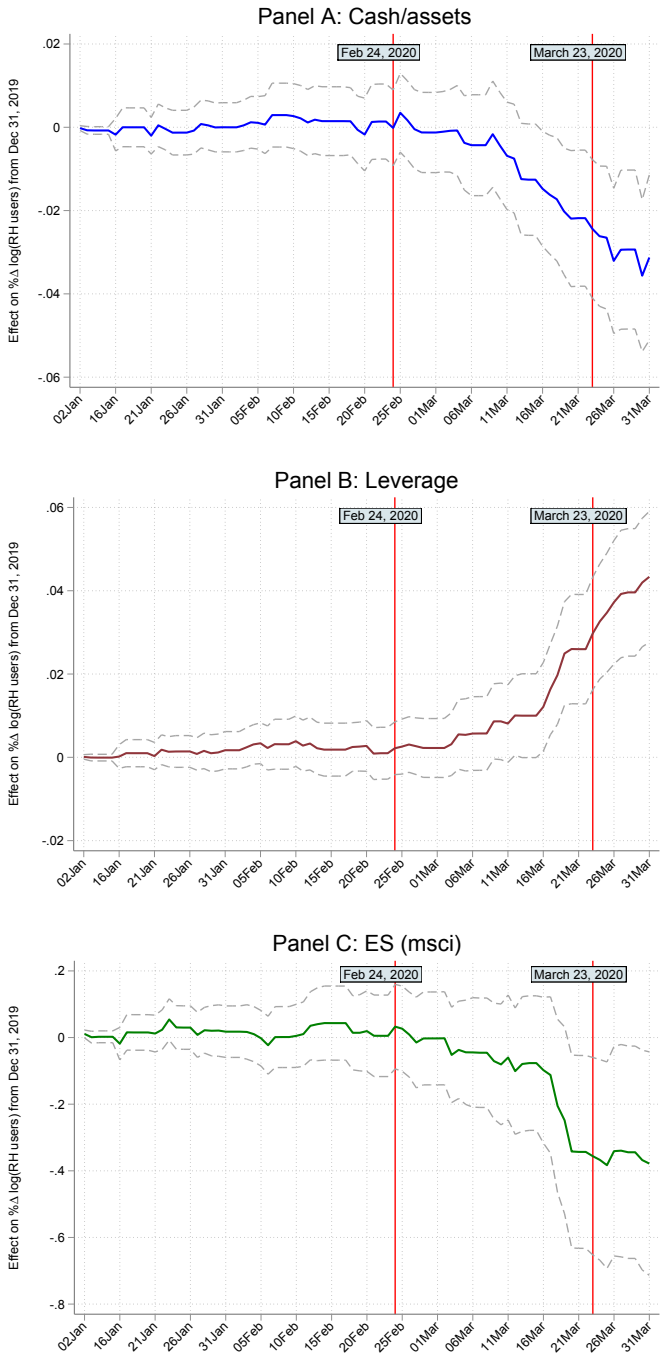


Figure 7: Net change in equity positions by institutional investor category
These graphs show the net changes in equity positions between 2019-Q4 and 2020-Q1 due to active trading by institutional investor category. These changes are estimated based on the ownership by investor category of non-financial 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.

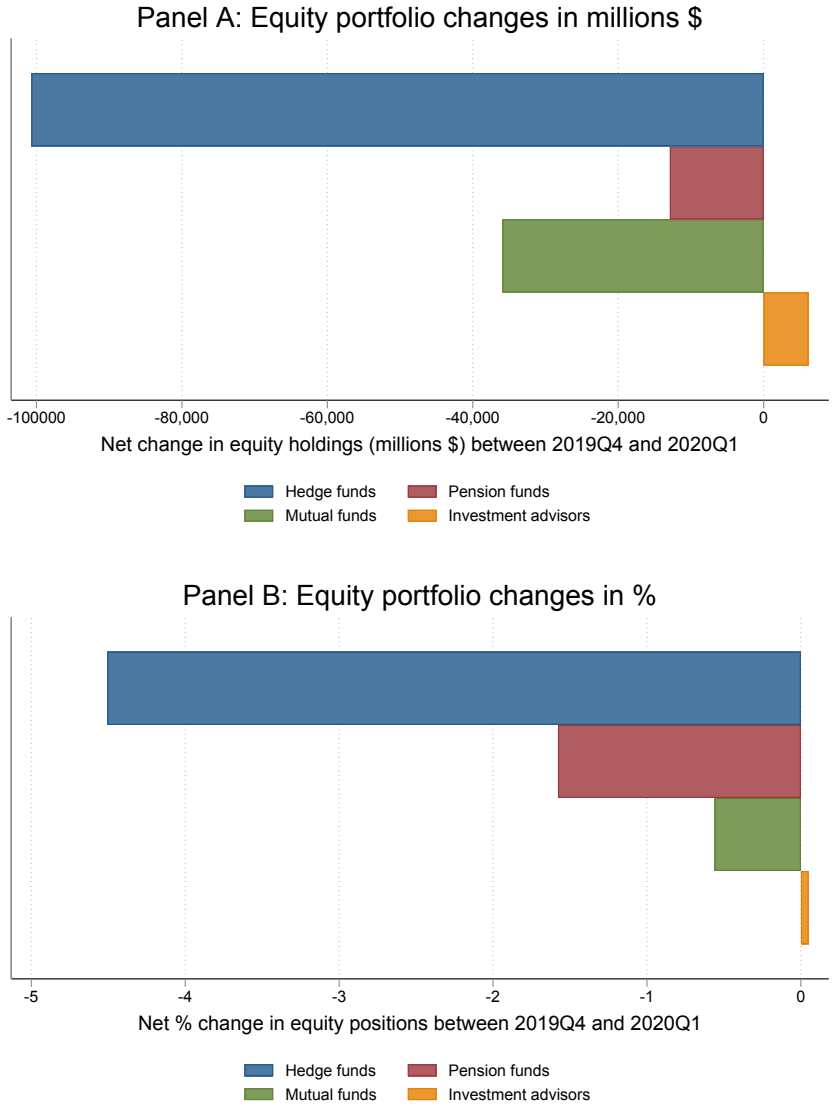
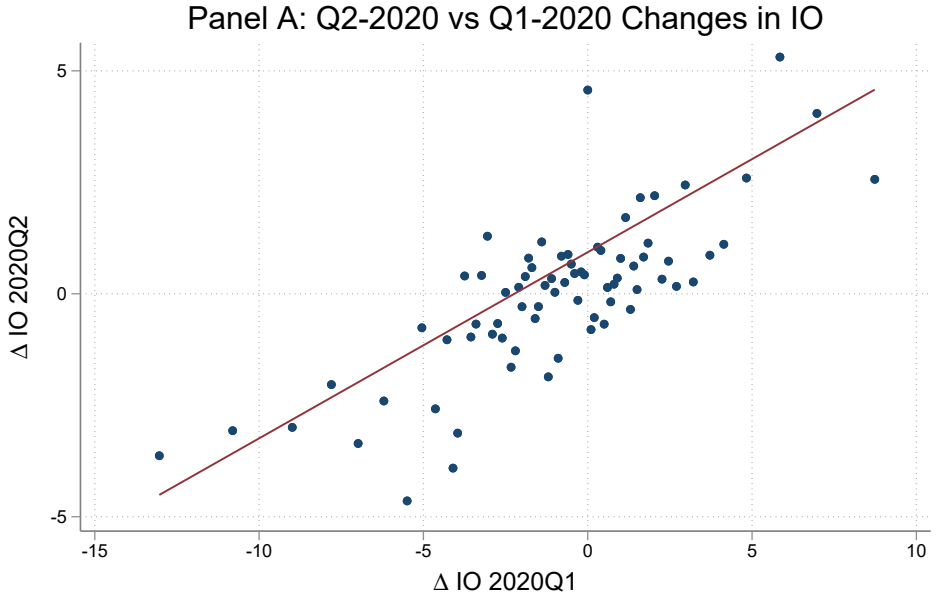
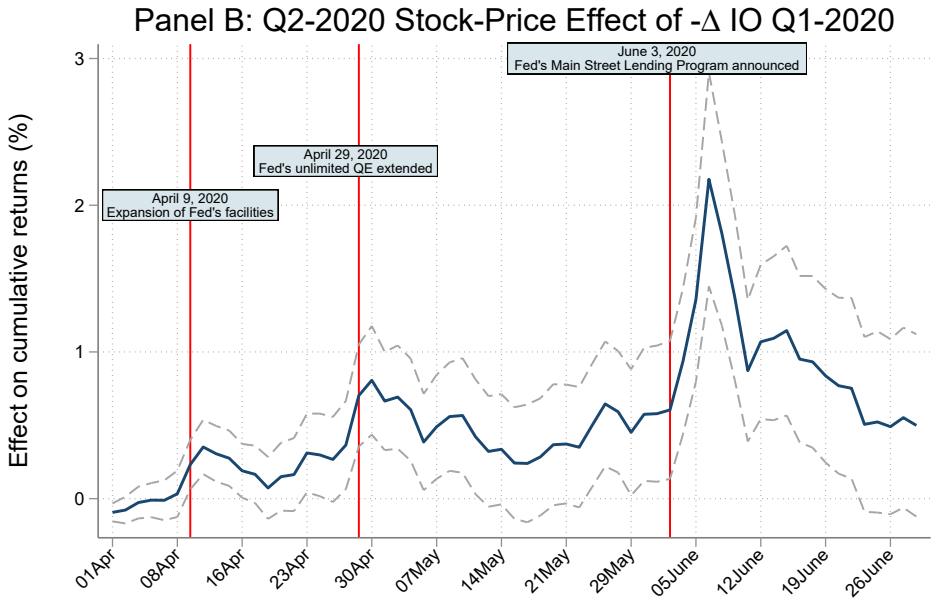


Figure 8: Stock returns during 2020-Q2 and correlation of changes in institutional ownership (IO) in 2020-Q2 vs 2020-Q1

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





Tables

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

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

Table 2: Stock returns and institutional ownership

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

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

Table 3: Evidence on institutional fire sales

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

Panel A: Interactions with institutional portfolio characteristics

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

Panel B: Controlling for changes in earnings expectations

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

Table 4: Determinants of changes in IO

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

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

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

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

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

Table 6: Determinants of changes in IO in 2020-Q2

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

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

Appendix

Table A1: Variable definitions

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

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

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

Environmental and social performance
Source: MSCI IVA

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

Internet Appendix

Figure OA1: Stock returns and IO -- 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). *IO* 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.

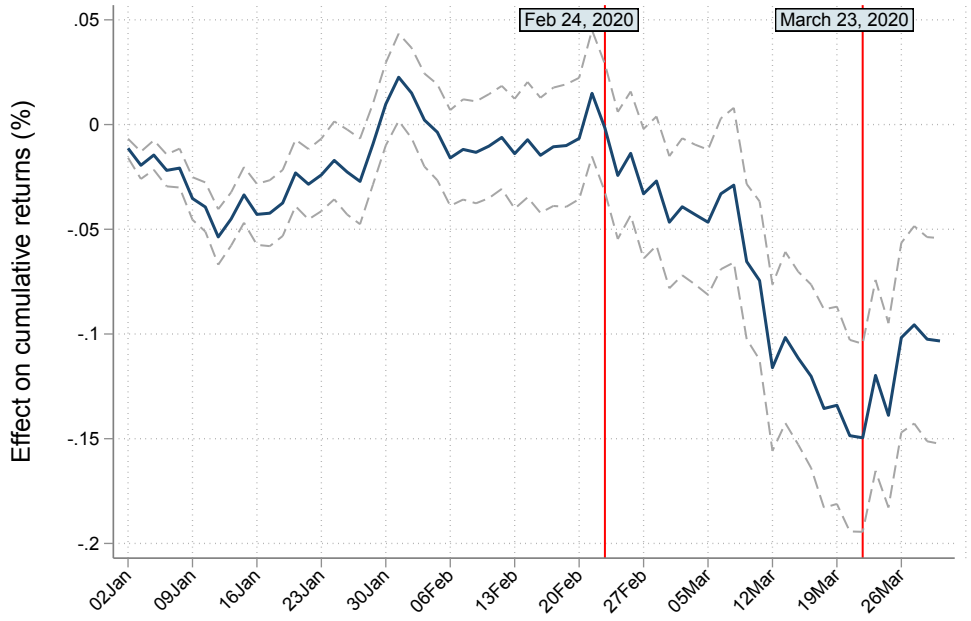


Figure OA2: Quarterly changes in IO during 2019

These graphs show the distribution of quarter-to-quarter changes in institutional ownership in 2019.

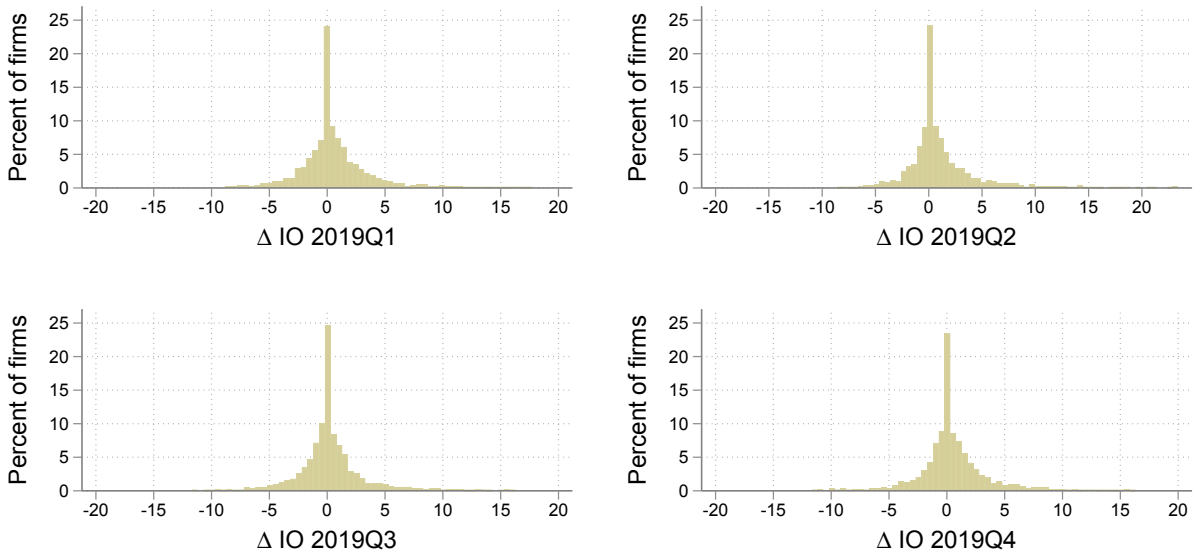


Figure OA3: Changes in IO: S&P500 firms and passive ownership
Panel A compares changes in institutional ownership between 2019-Q4 and 2020-Q1 of non-financial S&P500 firms vs. non-financial Russell 3000 firms not included in the S&P500 index. Panel B compares changes in overall institutional ownership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

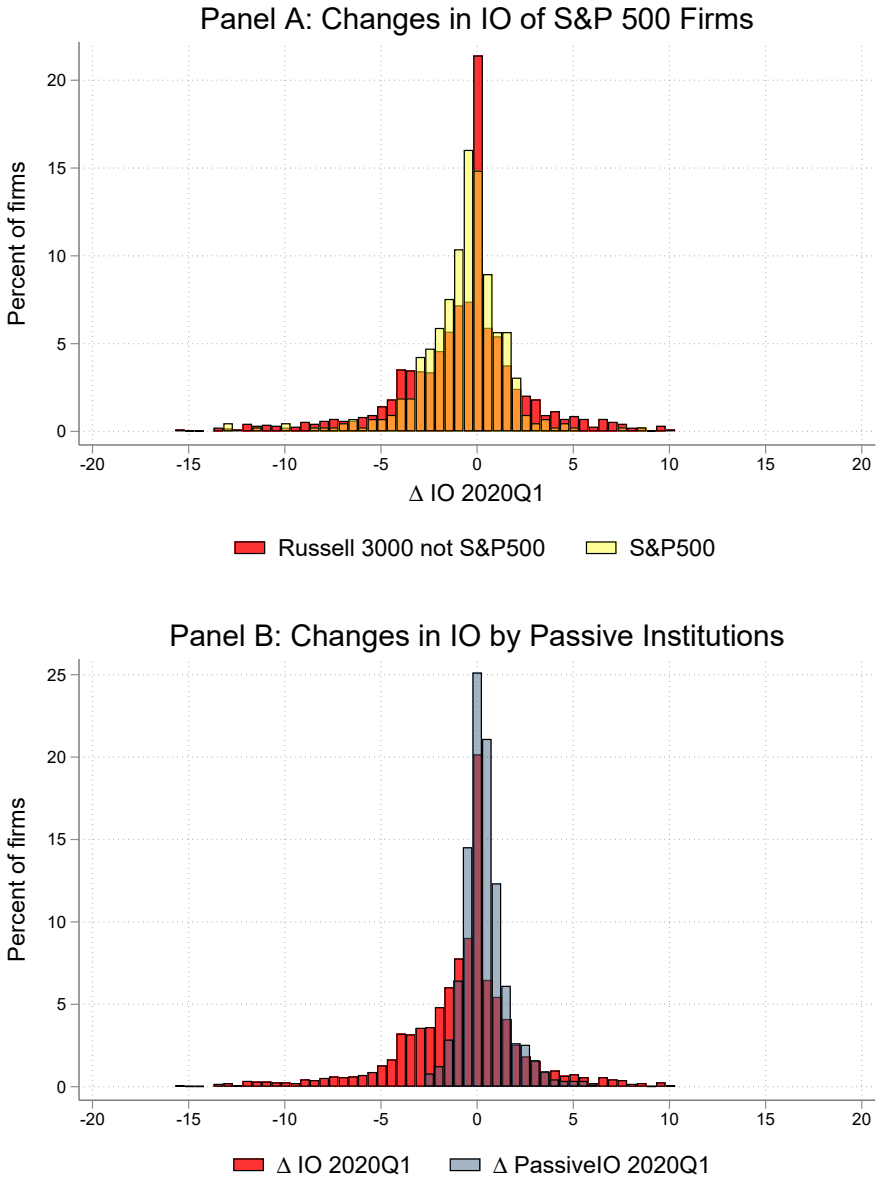


Figure OA4: Changes in IO: 2020-Q2 vs 2020-Q1
The graph shows the distribution of Δ *IO 2020Q2* compared to the distribution of Δ *IO 2020Q1*.

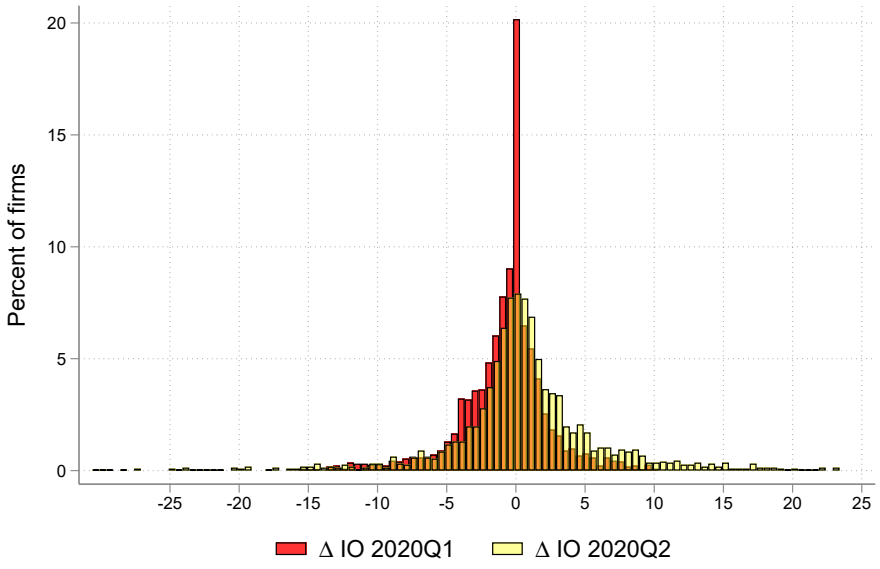


Figure OA5: Change in Robinhood investor popularity against change in IO during 2020-Q2

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.

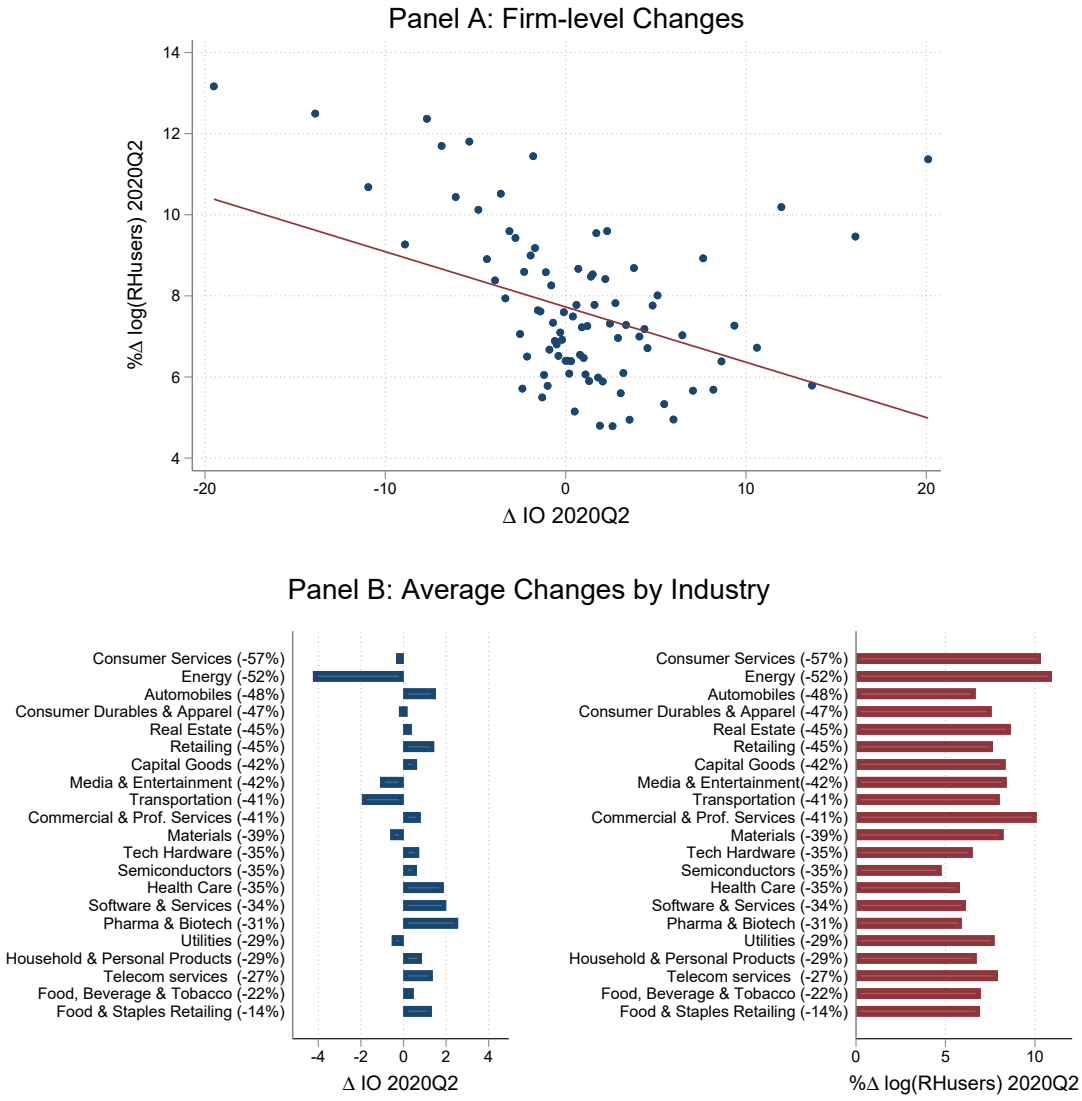


Figure OA6: Change in IO in 2020-Q2 and firm characteristics
Binned scatter plots of the net change in institutional ownership in 2020-Q2 on firm leverage, cash holdings, and environmental and social (ES) scores. The plots control for firm size, profitability, book-to-market, stock illiquidity, as well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

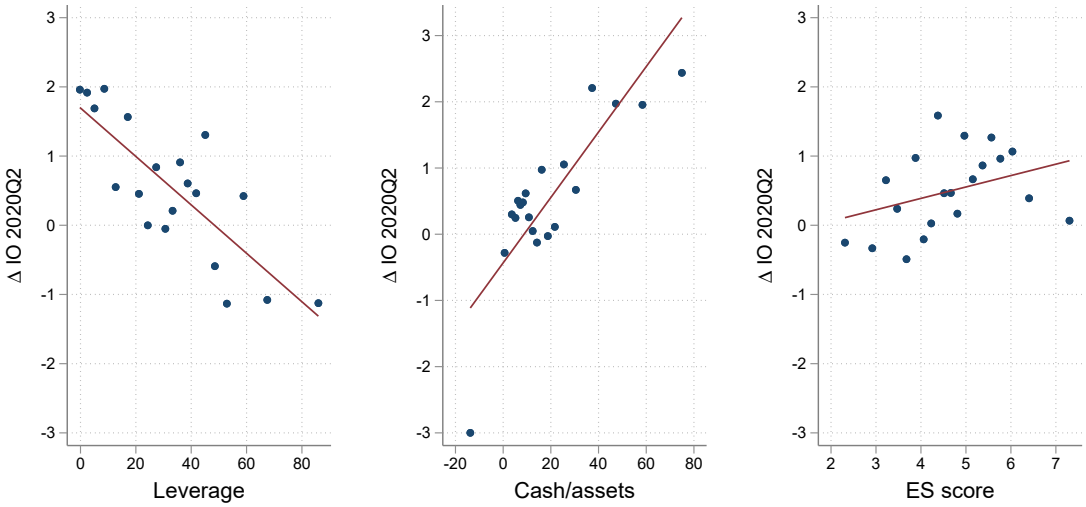


Figure OA7: Evolution of Robinhood investor interest and firm characteristics during 2020-Q2

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

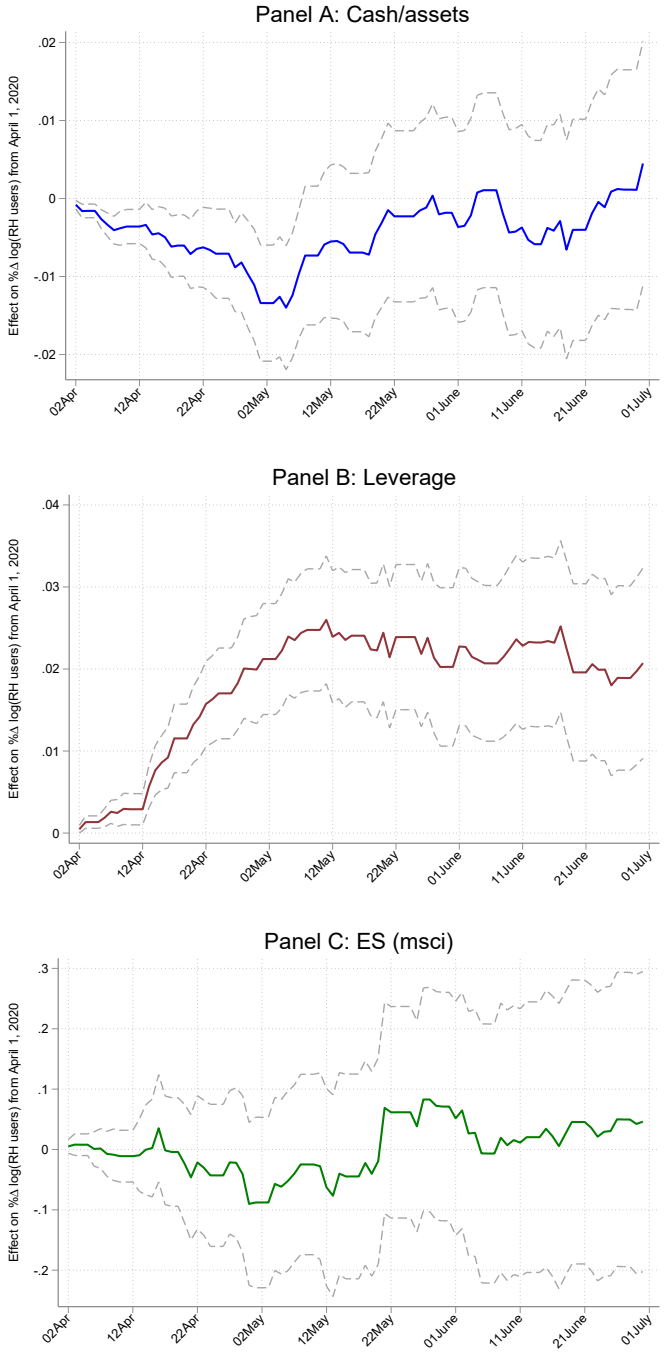


Table OA1: Determinants of changes in IO: Placebo tests

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

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

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