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Abstract

During the COVID-19 crash, U.S. stocks with higher institutional ownership performed worse. By studying firm-level changes in institutional ownership, we identify two mechanisms behind this effect: A sudden withdrawal of capital from the equity market and the collective attempt to re-position equity portfolios toward more COVID-resilient stocks. The stock-price effects of "portfolio downscaling" trades quickly reversed in the market's recovery phase, while those of "portfolio repositioning" trades lingered. The institutional rush for firm resilience also caused price pressures. Retail investors acted as counterparts and provided liquidity to stocks institutional investors sold, both during the turmoil and afterward. Overall, the results indicate that when a tail risk realizes, institutional investors amplify price crashes.

Keywords: Cash holdings, Corporate debt, COVID-19, Fire sales, Institutional ownership, Leverage, Retail investors, 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. But what is their role during crisis periods? In principle, the professional investment approach of institutional investors could help stabilize markets. However, Stein (2009) points out that when institutions enter the same trades and deleverage simultaneously, they could exacerbate stock market crashes.

In this paper, we use the onset of the COVID-19 pandemic at the start of 2020 to study how institutional investors react to a tail risk event. The exogenous and unanticipated nature of COVID-19 makes it a natural candidate for identifying the price effects of institutional ownership. The 2008-09 Global Financial Crisis (GFC), for instance, is less suitable for studying 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 the average level of institutional ownership (IO) was over 80% at the end of 2019, we exploit the substantial variation in the level of IO across our sample of U.S. non-financial Russell 3000 firms. We find that the prices of stocks with higher IO dropped more in the market correction in the first quarter of 2020. Our baseline result is displayed in Figure 1, which shows that 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 level of IO, controlling for firm and industry characteristics.[1] One standard deviation higher IO corresponds to almost one-tenth of a standard deviation lower cumulative

[1]In unreported tests, we find that the negative association between IO and stock returns during the Fever period also holds for non-US stocks in the MSCI ACWI index.

Fever return, a sizable effect, considering prior findings of the literature for other key variables such as leverage in the same period (Ramelli and Wagner, 2020; Fahlenbrach, Rageth, and Stulz, 2021). Such a strong negative relation between stock returns and IO has been very rarely observed in the previous 20 years. The effect holds even when controlling for revisions in analyst earnings forecasts during the Fever period and is mitigated by the presence of longer-horizon, passive, and foreign institutional investors.

-- Figure 1 --

To better understand why and how institutional investors amplified stock price movements, we study *changes* in firm-level institutional ownership in the first quarter of 2020.[2] The distribution of IO changes reveals an unusual average level of institutional selling activity triggered by the pandemic outbreak, but also significant heterogeneity across stocks. We classify IO changes into two different categories: those that originate from trading by institutions that significantly scaled down their equity portfolio in Q1-2020 (controlling for holdings' price changes), presumably to meet investor redemptions and reduce equity risk (hitherto referred to as *Downscaling IO changes*), and changes that are due to institutions that merely repositioned their equity portfolio holdings (*Repositioning IO changes*). To construct these variables, we classify "downscaling" institutions as those in the bottom decile of the change in the equity allocation (corresponding, in our case, to those with more than a 15.7% decrease in the equity portfolio).[3]

[2]The first quarter of 2020 is a plausible time frame to assess IO 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).

[3]We obtain similar results when using alternative thresholds, such as a 10% reduction in the allocation to equities.

We find that *Downscaling IO changes* are mostly unrelated to firm characteristics (apart from stock illiquidity, as one would expect based on the existing literature). Conversely, *Repositioning IO changes* show institutional investors actively increasing their holdings in firms considered more resilient to the COVID-19 shock (firms with lower leverage, higher cash, more optimistic earning forecast revisions, higher profitability, and lower book-to-market). These results are consistent with some investors indiscriminately liquidating parts of their equity positions in reaction to the sudden increase in liquidity risks and risk premiums at the onset of COVID-19, while others collectively re-positioned their portfolios toward more pandemic-resilient stocks.

How much did the different types of institutional investor trades impact stock prices in the middle of the market turmoil? We find that both types of trades are associated with significant stock-price impact during the Fever period. A back-of-the-envelope calculation based on our regression estimates suggests that, during the Fever period, downscaling and repositioning IO changes had stock-price impact multipliers of around 1.40 and 1.95, respectively. These numbers are in the ballpark of the stock-level price multipliers estimates in the literature, as reviewed in Gabaix and Koijen (2022).

Did the documented price effects of institutional trades revert over time? To answer, we study how IO changes are associated with stock returns from the end of the Fever period through year-end 2020. We observe a solid and swift reversal of the price effect of *Downscaling* Δ*IO Q1-2020*, consistent with a return to market tranquility after the Fed's promise of a massive injection of liquidity at the end of March 2020 (D'Amico, Kurakula, and Lee, 2020; Haddad, Moreira, and Muir, 2021). By contrast, we observe only a mild reversal of *Repositioning IO changes*, confirming that these reflect -- to a larger extent -- information about firm fundamentals. These results confirm the importance of understanding the different motives of institutional trading when studying their stock price impacts, as suggested by Edmans, Goldstein, and Jiang (2012) and Huang, Ringgenberg, and Zhang (2023) in the context of mutual funds' fire sales.

Importantly, even if the repositioning trades are driven by firm fundamentals, they can still cause excessive price pressures. In the few weeks of the Fever period, institutional investors simultaneously tried to rebalance their portfolios in the same direction toward firms considered more COVID-resilient, for instance, in terms of financial flexibility. This rush for resiliency is likely to have caused excessive price pressures. Confirming this prediction, we find that the stock-price effects of corporate leverage and cash during the Fever period are significantly amplified by the presence of institutional investors more exposed to high-leverage and low-cash firms and, hence, more "under stress" to reposition their portfolios and less likely to provide liquidity. These effects reverse after the Fever period through the end of 2020, which is consistent with excessive price pressures during a short-lived market crisis.

Finally, we study changes in firms' ownership in each quarter of 2020 to understand who provided liquidity to firms that institutional investors shunned in Q1-2020. In Q2-2020, institutions that liquidated a large part of their equity portfolios in Q1 did not simply revert their portfolio to the pre-COVID status, re-entering firms they exited; instead, they continued rebalancing their portfolio toward the same stocks their repositioning institutional investor peers preferred in Q1-2020. The other institutional investors continued moving their portfolios in the direction taken in Q1-2020, finishing their repositioning by the end of Q3-2020. Then, who caused the stock-price reversals we observed, especially related to downscaling IO changes? The most likely candidates are direct investments by individual investors in U.S. stocks. We utilize a new data set from Vanda Research. We find direct evidence that retail investors, both in Q1 and the rest of 2020, provided liquidity to stocks sold by institutional investors in Q1-2020 either for downscaling or repositioning reasons. In additional tests, we also document that Robinhood investors (a less representative class of retail investors) also significantly increased their attention to stocks sold by institutional investors in Q1-2020, especially for repositioning reasons. We conclude that individual investors played a significant role in the observed stock price reversals.

Our work contributes to three strands of research. First, we contribute to the literature on the impact of COVID-19 on equity markets, reviewed by Gormsen and Koijen (2023). Several papers investigate what caused the U.S. stock markets to decline by more than 34% during the Fever period. In particular, Gormsen and Koijen (2020), studying dividend futures, and Landier and Thesmar (2020), analyzing revisions of analysts' earnings forecasts, show that the extreme stock price drop cannot be explained exclusively by cash flow expectations, implying an important role of investors' risk appetite or sentiment. Looking at the cross-section of stock returns during and after the COVID-19 crash, Ramelli and Wagner (2020) and Fahlenbrach, Rageth, and Stulz (2021) identify investors' concerns about corporate financial flexibility (leverage and cash holdings) as significant drivers of stock returns. Ding et al. (2021), among other results, show that stock prices fell more for firms with higher ownership by hedge fund and asset management blockholders. By studying the relation between changes in institutional investors' equity portfolios to firm characteristics and individual stock returns, our paper contributes to this literature by shedding more light on the mechanisms behind the historical fluctuations in stock prices during the COVID-19 market turmoil and the following recovery period. We show that institutional investors magnified the crash through a sudden withdrawal of capital from equity markets and their collective attempt to re-position their portfolios toward more COVID-resilient firms. In this sense, our paper also relates to the growing literature studying how investors' demand shocks affect asset prices (Koijen and Yogo, 2019; Gabaix and Koijen, 2022).[4]

Second, our paper contributes to the broader literature on institutional investors' behavior during crisis episodes. Institutional investors are generally considered sophisticated actors that can improve stock market efficiency (e.g., 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 (e.g., Shleifer and Vishny, 1986; Dasgupta, Fos, and Sautner, 2021). However, research also indicates that institutional investors have a tendency to "herd" by trading in the same directions and exert significant downward pressure on prices (e.g., Nofsinger and Sias, 1999; Dennis and Strickland, 2002; Sias, 2004; Coval and Stafford, 2007; Dasgupta, Prat, and Verardo, 2011; Koch, Ruenzi, and Starks, 2016).[5] For instance, during the GFC, stocks held by short-term institutional investors and hedge funds performed significantly 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). The COVID-19 episode is particularly interesting for studying the

[4]While the demand-system-based asset pricing approach addresses the endogeneity between institutional demand and asset prices through instrumental variables, we address it by studying the behavior of institutional investors after an exogenous shock.

[5]Several other papers emphasize the risks of institutional ownership. Greenwood and Thesmar (2011) document that firms with institutional owners that face correlated liquidity shocks are more "financially fragile" and exhibit higher price volatility. 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.

behavior of institutional investors in the face of real shocks. While financial crises, such as the GFC, often emanate directly from within the financial sector and take time to unfold, the nature of the COVID-19 shock is exogenous to the financial system, and its timing is better understood (Gormsen and Koijen, 2023). In COVID-19, direct evidence of institutional fire sales is mostly limited to the corporate bond markets (see, in particular, O'Hara and Zhou, 2021; Haddad, Moreira, and Muir, 2021; Falato, Goldstein, and Hortaçsu, 2021). Our study provides novel evidence of COVID-19-triggered institutional trades in the equity market and their stock-price effects, both during the market turmoil and after the Fed's intervention in late March 2020. Our analyses also indicate which firm characteristics institutional investors associated with "quality" following the realization of a tail risk event.

Finally, while our focus is on institutional investors, our paper also speaks to the behavior of individual investors, often taken as the complement of institutional ownership. Our analyses provide additional color by explicitly studying retail investor behavior thanks to the availability of new data on retail investment flows in and out of individual U.S. stocks.[6] Our results on the role of individual investors as liquidity providers during the COVID-19 crash align with prior empirical and newer theoretical literature. For example, Barrot, Kaniel, and Sraer (2016) show that individual investors provide liquidity to the stock market during times of market stress. 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. Greenwood, Laarits, and Wurgler (2023) show that

[6]We also provide additional evidence of one, more specific group counterbalancing the institutions' trading, Robinhood (RH) investors, studied in more detail in other papers (e.g., Welch, 2021; Barber et al., 2022). Welch (2021) also concludes that RH investors were a (small) stabilizing force. Our analysis extends this by explicitly showing, for instance, that RH investors increased their appetite for low-cash and high-leverage stocks, precisely those sold by institutional investors in re-balancing their portfolios.

"stimulus checks" to U.S. taxpayers in 2020 and 2021 increased retail buying and share prices of retail-dominated stocks. Recently, Gabaix et al. (2023) find that, even when households take the opposite side of institutional trades, they are unlikely to be a significant stabilizing force to absorb market fluctuations, given their low demand elasticity. Our results on the relatively large price effects of institutional trades confirm this insight.

The rest of the paper is structured as follows. Section 2 describes the data and main variables. Section 3 documents the baseline stock-price effects of firms' institutional ownership level. Section 4 analyzes changes in institutional ownership by classifying these into institutional downscaling and repositioning changes. Section 5 illustrates the price effects of institutional trades in Q1-2020 and in the following quarters. Section 6 concludes.

2 Data

Our main sample consists of non-financial constituents of the Russell 3000 index as of the end of Q4-2019.[7] Table A1 in the Appendix provides detailed variable definitions.

2.1 Institutional ownership data

We retrieve firms' institutional ownership data from Q4-2018 through Q4-2020 from Factset (Ferreira and Matos, 2008). *IO Q4-2019* is the percentage of a stock's outstanding shares held by institutional investors derived from U.S. and international regulatory equity holding filings as of quarter-end Q4-2019.[8] In line with common practice in the literature, we truncate

[7] 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.

[8] Institutions with investment discretion over USD 100 million or more of U.S. publicly traded equity securities are required to disclose their holdings to the Securities and Exchange Commission (SEC) via 13-F

institutional ownership at 100% (Gompers and Metrick, 2001). We compute Δ*IO Q1-2020* as the change in institutional ownership from Q4-2019 to Q1-2020, conservatively trimmed at the 1st and 99th percentiles to control for extreme values (although this choice does not influence our findings).

To examine the role of investor heterogeneity, we classify institutional investors along different non-mutually exclusive categories based on their activeness, investment horizon, and origin. *Passive IO* is the percentage of institutional ownership held by large passive investors (BlackRock, Vanguard, and State Street). *Long-term IO* is the percentage of institutional ownership held by investors classified as long-term investors (Gaspar, Massa, and Matos, 2005). *Foreign IO* is the percentage of institutional ownership held by non-domestic institutional investors (Ferreira and Matos, 2008).

To disentangle the economic channels behind the institutional price pressure during the Fever period, we categorize institutional investors based on whether or not they significantly reduced their U.S. equity portfolios during the first quarter of 2020, net of the effect of individual holdings' returns over the same period.[9] A reduction in the equity portfolio could occur in response to (actual or anticipated) client redemptions or an increase in risk premiums. We classify institutional investors as "Downscaling" if they displayed a change in their equity portfolios below the 10th percentile during Q1-2020.[10] We chose the 10th percentile following the convention in the mutual fund literature (e.g., Coval and Stafford, 2007), but our results

form filings at the end of each calendar quarter.

[9]Specifically, we compute institutional investors' change in equity portfolios as the change in total disclosed equity assets between the end of Q4-2019 and Q1-2020 scaled by the total disclosed equity assets in Q4-2019. We adjust the change in total equity assets for stock price changes during Q1-2020.

[10]On average, Downscaling investors had 1.4 billion equity assets as of Q4-2019; in terms of investor category, 47% are mutual fund managers or investment advisors, 28% hedge funds, 14% private banking/wealth managers, and 11% other investors.

also hold when using alternative thresholds, such as a reduction (net of price changes) of more than -10% of the equity portfolio. *Downscaling* Δ*IO Q1-2020* is the change in firm-level institutional ownership by downscaling institutions. Formally, we define this variable as:

$$\textit{Downscaling } \Delta \textit{IO Q1-2020}_{i,t} = \sum_{j \in W} [\frac{\text{Holdings}_{i,j,t}}{\text{SharesOutstanding}_{i,t}} - \frac{\text{Holdings}_{i,j,t-1}}{\text{SharesOutstanding}_{i,t-1}}],$$

where W indicates the set of Downscaling institutional investors and $\text{Holdings}_{i,j,t}$ indicate the number of shares of firm i held by investor j at time t. *Repositioning* Δ*IO Q1-2020* is analogously defined as the change in firms' ownership by institutional investors not classified as Downscaling.[11]

We also decompose *Downscaling* Δ*IO Q1-2020* into "proportional" and "discretionary" changes in institutional ownership.[12] *Downscaling* Δ*IO Q1-2020 (prop.)* is the change in ownership by Downscaling institutional investors that would have occurred if institutions had scaled down their equity positions proportionally by keeping portfolio weights unchanged. *Downscaling* Δ*IO Q1-2020 (disc.)* is a firm's change in institutional ownership caused by discretionary portfolio choices by Downscaling institutions. We compute this variable as the difference between *Downscaling* Δ*IO Q1-2020* and *Downscaling* Δ*IO Q1-2020 (prop.)*.

To analyze the selling pressure generated by institutional investors without large downscaling in equity portfolios, we identify firm-level IO by repositioning institutional investors with an equity portfolio highly exposed to companies with high leverage or low cash holdings.

[11] *Downscaling* Δ*IO Q1-2020 (alt)* and *Repositioning* Δ*IO Q1-2020 (alt)* are slightly different versions of these variables, using a -10% change in the equity portfolio as the threshold to define Downscaling investors (instead of the 10th percentile).

[12] This decomposition is inspired by the analyses in Huang, Ringgenberg, and Zhang (2023). They study mutual fund flows and differentiate between "expected" mutual fund ownership changes and "discretionary" changes. Note that our measures are scaled by shares outstanding, not by dollar volumes, hence avoiding the potential issue highlighted by Wardlaw (2020).

Repositioning High-leverage IO and *Repositioning Low-cash IO* are the percentage of institutional ownership held by institutional investors that did not significantly reduce their equity portfolio in Q1-2020 but with above-median portfolio exposure to *Leverage* or below-median portfolio exposure to *Cash/assets* as of Q4-2019.[13]

2.2 Retail investor data

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

Specifically, we utilize data from Vanda Research and Robinhood Markets Inc. (RH). There are trade-offs in using these data. Vanda Research uses a proprietary research algorithm to provide daily data on retail investors' net purchases of U.S. stocks through its product VandaTrack. VandaTrack covers the entire U.S. stock market. We have access from 2014 through the end of 2022. The large coverage, both in terms of stocks and time periods, allows us to analyze the fever period and subsequent periods. The Vanda Research method, however, is proprietary. Documents provided to us by Vanda Research show that their method yields results that align reasonably well with data from Fidelity for retail holdings of the largest

[13]We calculate these variables by first computing a value-weighted portfolio exposure to firms' leverage and cash holdings (as of 2019Q4) for all repositioning investors. We then construct a stock-level variable capturing the percentage of outstanding shares held by institutional investors with below- and above-median portfolio exposure to cash holdings and leverage, respectively.

stocks. The data are also widely used by the financial press and, as such, are indirectly relied upon by many market participants.[14] We compute the variable *Retail flows Q1-2020* as the cumulative daily net retail dollar flows in individual stocks in Q1-2020 divided by the firm's market capitalization at the end of 2019, times 100.

RH was the first brokerage with zero-commission trades and over 10 million users traded on this electronic platform at the end of 2019. RH provided data only on the number of accounts that held a given stock in real time but not data on the amounts invested in individual stocks. We hence compute the variable *%Δ log(1+RHusers) Q1-2020* as the percentage change of log Robinhood users invested in a given stock between December 31, 2019, and March 31, 2020. One other concern is that individuals trading on this platform are not fully representative of the trading behavior of all U.S. retail investors (as also discussed in Barber et al., 2022).[15] RH data are only available through August 2020.[16]

We use both retail data sources because while RH data is more transparent, it was available only until mid-August 2020, it reflects only stock popularity and not actual investments, and it is arguably less representative of the average retail investor than data from Vanda Research.

[14] See, for example, *Financial Times*, "Meme-stock 2.0: Wall Street's retail trading boom is back" (February 17, 2023), *Wall Street Journal*, "Who You Calling Dumb Money? Everyday Investors Do Just Fine" (October 23, 2023), *Reuters*, "Retail investors seek to buy the dip on US megacaps -Vanda Research" (October 27, 2023), and *Bloomberg*, "Retail Traders Lose $350 Billion in Brutal Year for Taking Risks" (December 9, 2022).

[15] Robinhood investors tend to be young (median age of 30) and have between USD 1,000-5,000 in their brokerage account. Moreover, some of them choose 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.

[16] 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).

2.3 Stock returns and firm characteristics

Firms' stock data are from Compustat Capital IQ's North America Daily database. We label the period between February 24 and March 20, 2020, as the Fever period, following Ramelli and Wagner (2020) and other works employing a similar timeline (e.g., Gormsen and Koijen, 2020). Monday, February 24, is a natural starting point for that period, as on February 23, the first major COVID-19 outbreak in a Western economy occurred in Italy. Friday, March 20, is a natural endpoint 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. Similarly, we also compute individual stock returns from March 23 through the end of 2020, a period that we label as Recovery. *Market beta* is computed based on regressions of daily excess returns in 2019 on a constant and the daily market factor. *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. Based on the I/B/E/S database, we also compute the changes in analysts' earnings forecasts over the Fever period. 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.[17] For each firm, we focus on three different forecasting horizons: 2020

[17] Our definition of forecast revisions follows the approach used, for instance, in Liu, Shu, and Wei (2017). We obtain similar results when measuring revisions excluding negative baseline forecasts (e.g., in Landier and Thesmar, 2020) or taking the absolute value at the denominator (e.g., Ivković and Jegadeesh, 2004).

(accounting year ending in Q2-2020), 2021, and 2022. We conservatively trim the estimated forecast revisions at the 1st and 99th percentiles.

Finally, we obtain information on firms' environmental and social (ES) performance from Thomson Reuters Refinitiv/ASSET4, used in Albuquerque et al. (2020). We define the variable *ES score* as the average of the scores on the environmental and social pillar in 2018.

2.4 Descriptive statistics

Table 1 provides descriptive statistics. The average firm in the sample has cumulative returns in the Fever period of −39%, a market capitalization of USD 2,208 million, and institutional ownership of 81% as of quarter-end Q4-2019. With respect to the different institution types, we find that, on average, passive ownership is 16%, long-term ownership is 37%, and foreign ownership is 9%. During Q1-2020, IO levels for Russell 3000 stocks decreased by 0.7 percentage points on average (ΔIO *Q1-2020*). The average IO by downscaling investors dropped by 1.1 percentage points (*Downscaling* ΔIO *Q1-2020*), while repositioning institutional ownership increased by 0.4 percentage points (*Repositioning* ΔIO *Q1-2020*).

-- Table 1 --

3 Stock prices and institutional ownership

3.1 Main effects of institutional ownership

Although our main focus is on the *changes* in institutional ownership and their stock-price effects, we begin by examining the relation of cumulative stock returns over the Fever period (from February 24, 2020, through March 20, 2020) and the level of IO as of year-end 2019. Our set of control variables aims to capture stock and fundamental characteristics that could be potential drivers of the stock returns in Q1-2020 and correlate with the level of institutional ownership: *Leverage*, *Cash/assets*, *Market beta*, *Stock illiquidity*, *log(Market cap)*, *Profitability*, *Book-to-market* as of year-end 2019, as well as industry fixed effects.

-- Table 2 --

The regression results in column 1 of 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.[18] One standard deviation higher *IO Q4-2019* corresponds to around one-tenth lower standard deviation in cumulative Fever returns. This effect is economically 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 classified COVID-19 as a pandemic on March 11, 2020. Stock prices experienced a dramatic decline in that phase (e.g., Gormsen and Koijen, 2023).

We next examine the role of investor heterogeneity in terms of activeness, horizon, and domicile. Column 2 of Table 2 indicates that a higher percentage of *Passive IO Q4-2019* is

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

associated with more resilience. Column 3 indicates that a higher percentage of long-term institutional ownership is associated with relatively better stock price performance. This result on *Long-term IO Q4-2019* is consistent with the work by Cella, Ellul, and Giannetti (2013) on the amplification of market shocks by short-horizon investors. Finally, column 4 indicates that U.S. stocks with higher foreign IO experienced better stock price performance. The result on *Foreign IO Q4-2019* 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.

3.2 Robustness

In Table A2 in the Appendix, we report the results on the stock-price effects of IO using alternative specifications. First, we remove the log of market capitalization from our battery of controls to ensure that our results are not driven by a potential mean reversion effect. Second, we remove GICS industry group fixed effects and include instead the measures (at the more granular 3-digit NAICS level) proposed by Dingel and Neiman (2020) (*Teleworkable jobs*) and Koren and Pető (2020) (*Affected share*) of how much job activities in different sectors are exposed to the pandemic's social distancing measures. Third, we control for momentum, defined as a stock's return from January 2 through February 21, 2020, before the start of the Fever period. Fourth, we control for stocks' loading on the size and value betas. Fifth, we control for firms' ES scores as in Albuquerque et al. (2020). Finally, we control for analyst earnings forecast revisions during the Fever period to ensure that the relation between stock prices during the crisis and institutional ownership at the end of 2019 is not merely a reflection of institutions being systematically positioned in firms hit harder by the crisis.[19] Our finding on the impact of IO remains unchanged when employing these alternative specifications.

Finally, to illustrate the uniqueness of the COVID-19 episode in historical terms, we run 1,054 cross-sectional regressions of weekly stock returns on prior-quarter IO from April 2000 through March 2020, controlling for the effects of the same firm characteristics as in Table 2. 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).[20]

-- Figure 2 --

[19]Of course, stock returns and revisions in analysts' earnings forecasts are closely aligned as they are both influenced by expectations about firms' fundamentals. However, Chaudhry (2024) shows that analysts change their cash flow expectations also directly in response to stock price increases, even when unrelated to firm fundamentals. In this sense, it may be possible that at least part of earning forecast changes during the COVID-19 crash (studied in detail in Landier and Thesmar, 2020) are driven by institutional investor trading and the resultant impact on prices.

[20]This historical analysis also indicates the special effect of IO during COVID-19 relative to the typical cross-section of stock returns. However, when comparing the estimated COVID-19 coefficient with those in the pre-event period -- in the spirit of Cohn, Gillan, and Hartzell (2016), and more recently, Cohn et al. (2023) --, we should recall the exceptional nature of the COVID-19 episode in terms of return variability, itself caused by our variable of interest, IO.

4 Changes in institutional ownership

In this section, we study changes in institutional ownership to shed light on the actual behavior of institutional investors during the COVID-19 crisis. We start by describing the overall distribution of IO changes during Q1-2020, and how it compares to previous quarters. We then examine two different types of IO changes, those triggered by institutional equity portfolio downscaling and those by institutional portfolio rebalancing, and how they relate to firm characteristics.

4.1 Descriptive evidence

To provide descriptive evidence on institutional investors' trading, Figure 3 plots, in Panel A, IO changes in Q1-2020 and compares them against IO changes in Q4-2019. We observe a highly negative skewed distribution of the firm-level changes in IO in Q1-2020, 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.[21]

-- Figure 3 --

If institutions behaved (in aggregate) as net sellers, which market participants took the other side of their trades? The most natural candidates are individual investors (households), who are usually estimated as the residual of institutional holdings (e.g., Koijen and Yogo, 2019). However, there are also other groups of shareholders other than 13-F investors (e.g.,

[21]Figure A1 in the Appendix shows the distributions of the IO changes in each of the four quarters of 2019 are also symmetric as in Q4-2019.

insiders and control shareholders). Our measures of retail flows from Vanda Research allow us to provide more direct evidence of the behavior of individual investors. Panel B of Figure 3 shows in a binned scatter plot a strong negative correlation (-.20, $p < 0.001$) between individual-stock changes in IO during Q1-2020 and cumulative retail flows over the same period. Figure A2 in the Appendix shows that we find a similar negative relation when employing our alternative measure of retail flows, the percentage change in the log of (one plus) Robinhood users holding a given stock between December 31, 2019, and March 31, 2020.

4.2 Disentangling downscaling and repositioning IO changes

In this section, we disentangle institutional ownership changes in downscaling and repositioning driven. We then study how both types of trading activities relate to stock characteristics.

Figure 4 shows the distributions of *Repositioning* ΔIO *Q1-2020* (Panel A) and *Downscaling* ΔIO *Q1-2020* (Panel B). While repositioning changes are well distributed around 0, downscaling IO changes are mostly on the negative side, as one would expect.

-- Figure 4 --

Interestingly, downscaling IO changes are mostly, but not *entirely* negative. The reason is that not all downscaling trades are indiscriminate, in the sense of affecting all the portfolio holdings equally. Some investors may decide to change individual holdings' weights as they scale down their equity portfolio, as documented in Huang, Ringgenberg, and Zhang (2023).[22]

[22] In line with this intuition, Figure A3 in the Appendix shows the distributions of the two sub-types of downscaling IO changes: proportional and discretionary. While the proportional component is always negative, the discretionary component also has positive values.

To better understand the drivers of IO changes, in Table 3, we regress *Downscaling* ΔIO *Q1-2020* (columns 1-3) and *Repositioning* ΔIO *Q1-2020* (columns 4-6) on firm characteristics.[23] We observe that Downscaling IO changes are, as expected, mostly unrelated to key firm characteristics such as leverage, cash holdings, and revisions in analyst forecasts during the Fever period. Investors that experienced large equity portfolio downscaling, however, appear to have sold more liquid stocks, in line with a key result in the fire sale literature and the COVID-19 behavior in the bond mutual fund and corporate bond markets documented in Ma, Xiao, and Zeng (2022) and O'Hara and Zhou (2021). In contrast, firm characteristics are important in explaining institutional investors' portfolio-repositioning trading (columns 4-6). Investors actively increased their positioning in low-leverage and high-cash firms and in firms considered by analysts as more cash-flow resilient to COVID-19. They also appear to have preferred firms with more ex-ante profitability and lower book-to-market.[24] These patterns are illustrated in Figure 5.

-- Table 3 and Figure 5 --

Overall, these analyses portray two types of reactions of institutional investors to an exogenous disaster like COVID-19: A sudden withdrawal of capital from the equity market and a collective rebalancing of equity portfolios toward more financially resilient firms. The following section analyzes the impacts of these two reactions on market prices.

[23] In Appendix Table A3, we observe similar patterns using the alternative measures of IO changes based on the 10% investor downscaling cutoff instead of the 10th percentile cutoff.

[24] Although our primary focus is on the role of firms' financial flexibility, in Appendix Figure A4, we employ measures at the 3-digit NAICS level from Dingel and Neiman (2020) and Koren and Pető (2020) and find that Repositioning investors actively moved toward sectors less exposed to social distancing, while Downscaling investors did not.

5 Stock-price effects of institutional tradings

5.1 Stock price effects in the Fever and Recovery periods

In this section, we study the effects of downscaling and repositioning changes in IO in the cross-section of the stock-price reactions to COVID-19. Table 4 reports the results of regressions of individual stock returns in the Fever period (from February 24 to March 20, 2020, columns 1-3) and in the Recovery period (from March 23 through December 31, 2020, columns 4-6) on the ΔIO measures.[25] Consider first the stock-price effects in the Fever period. The estimated coefficient on *ΔIO Q1-2020* shows the overall price effects associated with changes in IO in Q1-2020. A one-standard-deviation lower *ΔIO Q1-2020* (3.04) is associated with around 2.2% lower stock returns in the Fever period.

-- Table 4 --

In column 2, we look at our two main sub-measures of *ΔIO*, *Downscaling ΔIO Q1-2020* and *Repositioning ΔIO Q1-2020*. Both measures appear to be strongly associated with stock returns in the Fever period. A one-standard-deviation lower *Downscaling ΔIO Q1-2020* (1.16) is associated with around 1.40% lower stock returns, while a one-standard-deviation lower *Repositioning ΔIO Q1-2020* (3.24) is associated with around 1.91% lower stock returns.

Based on our estimates, we can perform a back-of-the-envelope estimation of the price-impact multiplier of IO changes, following the logic of Koijen and Yogo (2019) and Gabaix and Koijen (2022), applied also in other works (e.g., Ben-David et al., 2022; Hartzmark and Solomon, 2022). The firm-level price multiplier is the percent price change when an investor

[25] In the Appendix, we report the results using alternative specifications, controlling for earning forecast changes (Table A4) and using the ΔIO measures based on the alternative downscaling cutoff (Table A5).

purchases a certain fraction of a firm's outstanding shares (Gabaix and Koijen, 2022).[26] While we do not follow a structural demand system asset pricing approach, our exercise can rely on the exogenous shock in institutional demand caused by COVID-19.

In our setting, the average *Downscaling* ΔIO *Q1-2020* is -1.05%, while its estimated stock-price effect is 1.20% (Table 4, column 2). Accounting for the fact that institutional investors hold, on average, 81.04% of shares outstanding, this gives us a price multiplier estimate of $\frac{1.20\%}{-1.05\%} \times \frac{1}{81.04\%} = 1.40$. Following the same reasoning, the price multiplier implied by our estimates on *Repositioning* ΔIO *Q1-2020* is $\frac{0.60\%}{0.38\%} \times \frac{1}{81.04\%} = 1.95$. These numbers are in the ballpark of the firm-level multiplier estimates reported in the literature (with an order of magnitude around 1, according to Gabaix and Koijen, 2022).[27] Traditional asset pricing theory suggests that equity markets can absorb any change in the investor demand for a given stock without impact on its price, which should be exclusively determined by firm fundamentals. In other words, the stock market is assumed to have an infinite price elasticity of demand, the inverse of the price multiplier. Our results confirm that this is, in fact, not the case, in line with the most recent literature.[28]

In the second part of Table 4 (columns 4-6), we explore how the same measures of IO

[26] As also suggested by Hartzmark and Solomon (2022), it is helpful to think at changes in demand for a given stock in terms of the fraction of outstanding shares that are added to a stock's limit order book, as a sell or buy order, over a certain period.

[27] Our multiplier estimates focus on the price impact of the overall class of institutional investors. Koijen, Richmond, and Yogo (2023) show that one can also estimate the impacts of different institutional investors relative to their size in the market. For instance, in our setting, Downscaling investors (those who, by definition, sold a large share of their equity portfolios) had a much higher repricing impact than institutional investors overall. In fact, these investors account, on average, for only 3.92% of stock ownership at the end of 2019. This implies a price multiplier of: $\frac{1.20\%}{1.05\%} \times \frac{1}{3.92\%} = 29.08$.

[28] The cross-sectional analyses also tell us something about the performance of the stock market as a whole. In Table A6 in the Appendix, we run regressions of individual stock returns in the Fever period weighted by market capitalization. The average value-weighted return in our sample is around -30.75%. We find an estimated price effect of Downscaling ΔIO Q1-2020 of around 4.9, which, multiplied by a value-weighted average value of -0.84, gives us an estimated price effect of -4.12%. In other words, more than one-tenth of the historical market drop observed in February and March 2020 appears attributable to the behavior of downscaling institutional investors.

changes are associated with stock returns over the Recovery period (i.e. from the end of the Fever period through year-end 2020). In column 5, we observe a strong reversal of the price impact of *Downscaling* Δ*IO Q1-2020*, while there is no statistically significant reversal of the impact of *Repositioning* Δ*IO Q1-2020*. In particular, a one-standard-deviation lower *Downscaling* Δ*IO Q1-2020* (1.16) is associated with around 8.44% higher stock returns in the market rally of the Recovery period.

Figure 6 illustrates the evolution of the estimated effects of *Downscaling* Δ*IO Q1-2020* (Panel A) and *Repositioning* Δ*IO Q1-2020* (Panel B) on individual stocks' buy-and-hold returns from the start of the Fever period to each day through the end of the second quarter of 2020. A higher value of the plotted estimated coefficients indicates a stronger price impact of IO changes, hence, a greater price drop following more institutional selling pressure. The effect of downscaling IO changes spikes toward the end of the Fever period and then reverses afterward, in line with the interpretation that institutional downscaling trades in Q1-2020 were triggered by increased liquidity concerns and risk premiums. In contrast, the price effect associated with *Repositioning* Δ*IO Q1-2020* also grows rapidly in the Fever period but then persists well beyond its end, consistent with the interpretation that institutional investors reshuffled their portfolios toward stocks more resilient to COVID-19.

-- Figure 6 --

We break down *Downscaling* Δ*IO Q1-2020* in its proportional and discretionary parts, in the spirit of Huang, Ringgenberg, and Zhang (2023). Table 4 (columns 3 and 6) shows that both downscaling components appear to have caused significant price pressure in the Fever period. However, between the two sub-measures of downscaling IO changes (column 6), only the proportional component is associated with a significant reversal, while the discretionary part is not. This result at the institutional investor level aligns with the findings of Huang, Ringgenberg, and Zhang (2023) in the context of mutual funds' fire-selling behavior.

Finally, one may wonder whether the price effects we document are driven exclusively by the deleveraging of hedge funds, a specific class of institutional investors whose fire-selling behavior has been documented in both the Dot-Com bubble (Brunnermeier and Nagel, 2004) and the Global Financial Crisis (Ben-David, Franzoni, and Moussawi, 2012). In Table A7 in the Appendix, we study the stock price effects of IO changes by hedge funds and other institutions separately. We conclude that our results are not driven exclusively by hedge funds. Both hedge funds and other institutional investors impacted stock prices in the Fever period through portfolio downscaling, followed by a stock-price reversal in the Recovery phase. Interestingly, we do not observe any significant effects on stock returns resulting from hedge funds' portfolio re-balancing, contrary to what we observe for other types of institutional investors.

5.2 Price pressure from portfolio repositioning

In the previous section, we documented that institutional investors, those more likely to be the marginal investors in public firms, influenced stock prices during the COVID-19 crash through two different channels: The withdrawal of capital from equity markets and their collective re-positioning of their portfolios toward more COVID-resilient stocks. Prior literature has shown that a sudden withdrawal of capital can induce price pressure. In our setting, we document that reallocations of institutional capital *within* equity portfolios, if executed simultaneously, can also cause excessive price movements.

In Table 5, we investigate the stock price effects of two major determinants of firms' cash-flow prospects during COVID-19 (leverage and cash holdings) and the institutional ownership factors likely to have exacerbated them. In Panel A, we first focus on the role of the institutional investor base's exposure to high-leverage (*Repositioning High-leverage IO Q4-2019*) and to low-cash firms (*Repositioning Low-cash IO Q4-2019*).[29] To emphasize the role of rebalancing portfolio decisions, these measures are computed exclusively based on investors who do not display large downscaling in Q1-2020. Columns 1 and 2 show that higher ownership by institutional investors with an ex-ante riskier portfolio (either in terms of high-leverage or low-cash exposures) is associated with a significant *amplification* of the stock price effects of firms' financial flexibility during the Fever period. For instance, a one-standard-deviation higher *Repositioning High-leverage IO Q4-2019* (20.54) is associated with an increase in the direct stock-price impact of leverage of -0.041, which represents more than one-third of the average effect of leverage estimated in Table 2 (-0.108). A one-standard-deviation higher *Repositioning Low-cash IO Q4-2019* (12.56) is associated with an increase in the direct stock-price impact of cash holdings of +0.113, which is more than the average effect estimated in Table 2 (0.082).

-- Table 5 --

We interpret these stock-price effects of portfolio repositioning as excessive in the sense that the same firm characteristic is priced differently based on whether there are more or

[29] Our approach is similar to the one employed, for instance, in Ellul, Jotikasthira, and Lundblad (2011). They show that the price decline (and subsequent reversal) following a bond's downgrade is larger for bonds owned by investors that are more regulatory-constrained and, hence, more willing to sell the bond even at a depressed price.

fewer investors anxious to trade on it. In line with this interpretation, we observe the amplification effects reverting in the Recovery period (see columns 3 and 4). While prior literature identifies financial strength as a major driver of firms' cash-flow prospects during crises, this finding indicates that the financial exposure of institutional investors themselves can create spillover effects on portfolio companies.

Similar to the reasoning above, the price pressures from the collective repositioning of institutional portfolios depend on the likelihood of finding potential counterparties, which, in turn, depends on other investors' price elasticity of demand (e.g., Koijen, Richmond, and Yogo, 2023; Pavlova and Sikorskaya, 2023). In this spirit, we expect more excessive price movements in stocks with a higher share of passive investors, those with the most inelastic demand by definition. To test this prediction, in Panel B, we interact leverage and cash with the share of passive IO as of Q4 2019. We find that a higher share of passive IO is associated with an amplification of the price effects of leverage and cash holdings during the Fever period. These extra price impacts reverse in the following period, though the coefficient on the interaction term in column 4 is not statistically significant.

5.3 Who provided liquidity?

In this final analysis, we explore which class of investors caused the stock-price reversals we documented in the previous sections. Answering this question is relevant because it allows us to better understand how investors, particularly institutional ones, behave not only during a crash but also afterward when market confidence is restored. The COVID-19 crash, thanks to its well-defined timing, offers a unique opportunity in this respect.

First, in Table 6, we examine the trading of the subset of institutions that do display large downscaling in Q1-2020 versus those that do not. Specifically, we regress firm-level IO changes during Q2-, Q3-, and Q4-2020 originating from the two categories of investors (*Downscaling* ΔIO and *Repositioning* ΔIO, respectively) on firm-level IO changes in Q1-2020 and firm characteristics. Columns 1-3 focus on institutions that display a large downscaling of their equity portfolio in Q1-2020. The results in column 1 indicate that, in Q2-2020, these investors did not move their equity portfolios back into the stocks that they had left. Instead, they moved toward the same stocks that repositioning investors preferred in Q1-2020. In other words, when downscaling investors re-entered the equity markets, they did not simply revert their portfolios to the pre-COVID status but bought firms considered more resilient to the pandemic. We do not observe any additional significant repositioning in the rest of 2020, apart from a significant appetite for high-cash firms in Q4-2020.

-- Table 6 --

Columns 4-6 of Table 6 investigate the behavior of institutions that repositioned their equity portfolio in Q1-2020 without significantly downscaling it. We observe that, in Q2-2020, these investors kept preferring the same stocks they preferred in Q1-2020 and continued repositioning their portfolios toward highly financially resilient stocks. By the end of Q3, they appear to have finished their repositioning. Interestingly, these investors did not buy stocks abandoned in Q1 by their fellow downscaling institutional investors.

If neither class of institutional investors reverted their trades toward stocks that had a more negative Downscaling ΔIO in Q1-2020, which investors caused the strong price reversals documented in the previous subsections? The most likely candidates are individual investors.

To investigate this, in Table 7, we regress individual-stock quarterly retail (net) flows during each of the quarters of 2020 on IO changes in Q1-2020 and firm characteristics.

-- Table 7 --

In column 1, we confirm the strong opposite relation between individual investor investment flows and institutional trades, either driven by downscaling or repositioning. In column 2, we find that retail investors continued to move into stocks shunned by institutional investors in Q2 and, particularly for more negative *Downscaling* Δ*IO Q1-2020* firms, also Q3-2020. The effect is economically important. For instance, a one-standard-deviation higher *Downscaling* Δ*IO Q1-2020* (1.16) is associated with around one-tenth of the standard deviations in retail flows in Q2-2020 and again in Q3-2020.

Of course, not all individual investors are likely to have behaved the same. In Appendix Table A8, we regress the Q1 and Q2-2020 changes in stock popularity among Robinhood investors on measures of IO changes in Q1-2020. Thus, this analysis parallels that in Table 7, but considers an arguably smaller (and thus less representative) class of individual investors studied in other recent papers (e.g., Welch, 2021; Barber et al., 2022) and studies only *changes* in a stock's number of holders instead of investment flows. We can conduct this analysis only for two quarters as Robinhood data became unavailable after August 2020. We find that, in Q1-2020, Robinhood investors strongly entered stocks left by institutional investors for repositioning reasons, while it does not appear they took the opposite side of downscaling institutional sales. In Q2-2020, we do not observe any significant additional change in Robinhood attention toward stocks affected by institutional trades in the first quarter. However, Robinhood investors continued to express a stronger appetite for high-leverage and low-cash stocks.[30]

Overall, these results complement our earlier evidence of institutional ownership changes and provide further indication that individual investors provided liquidity to stocks shunned by institutional investors after COVID-19 struck, at least partially fuelling the stock market recovery.

6 Conclusion

The impact of a negative real shock on corporations (and, hence, even society at large) also depends on the reactions of their shareholders. Given that the majority of equity markets are nowadays held by institutional investors, it is essential to understand their behavior when a disaster strikes. By analyzing U.S. individual stock returns and institutional ownership changes during and after the initial COVID-19 outbreak, we show that institutional investors significantly contributed to amplifying the historical stock market crash. We identify two major types of institutional reactions to COVID-19: A significant and largely indiscriminate withdrawal of capital from the equity market -- consistent with the sudden increased liquidity concerns and risk premiums -- and a collective rush to rebalance equity portfolios toward firms considered more resilient to the pandemic, especially in terms of financial flexibility.

Both reactions impacted prices considerably during the COVID-19 market fever, but with different effects in the recovery phase. After the Fed ended the market storm, the price impact of downscaling institutional trades quickly reversed, while those of portfolio repositioning mostly lingered. Still, we show that fundamental portfolio repositioning, because

[30] We obtain similar results when regressing the levels of Robinhood holders of a given stock, using a Poisson model as recommended in Cohn, Liu, and Wardlaw (2022).

collectively and mostly uni-directionally executed, caused excessive price pressure on some firms, which reverted afterward. In all this, individual investors took the opposite side of institutional trades and appear to have fueled the stock market rally in the recovery period.

Our results shed more light on the mechanisms behind the historical fluctuations in equity markets triggered by COVID-19, which prior literature considers too extreme to be explained only by a revision in cash flow expectations (Landier and Thesmar, 2020; Gormsen and Koijen, 2020, 2023). Our finding that when a tail risk realizes, institutional investors amplify price crashes has important implications for both macro-financial stability and corporate management. Mispricing in equity markets can have direct material consequences on many corporate decisions, as the literature on the real effects of non-fundamental price pressure indicates (see Goldstein, 2023, for a review). Recent evidence in Friberg, Goldstein, and Hankins (2024) suggests that firms preemptively respond to their stock price fragilities by taking precautionary actions. In this sense, our results indicate that, even in normal times, companies should be mindful of their shareholder base and balance the advantages of institutional investors with their potential behavior in crisis periods.

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Figures

Figure 1: Stock prices and institutional ownership
This graph shows the evolution of the coefficients on *IO Q4-2019* 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 Q4-2019* 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.

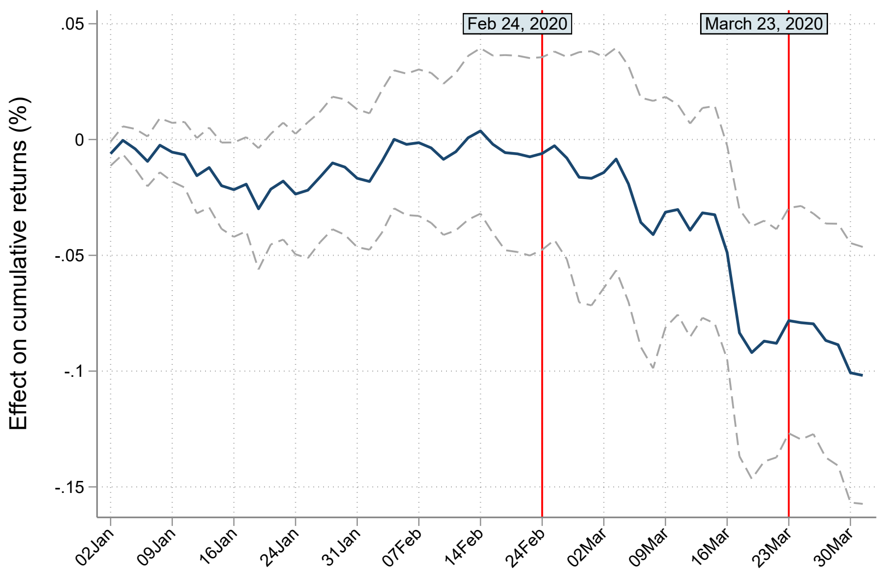


Figure 2: Historical perspective on the relation between institutional ownership (IO) and stock returns

This graph 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.

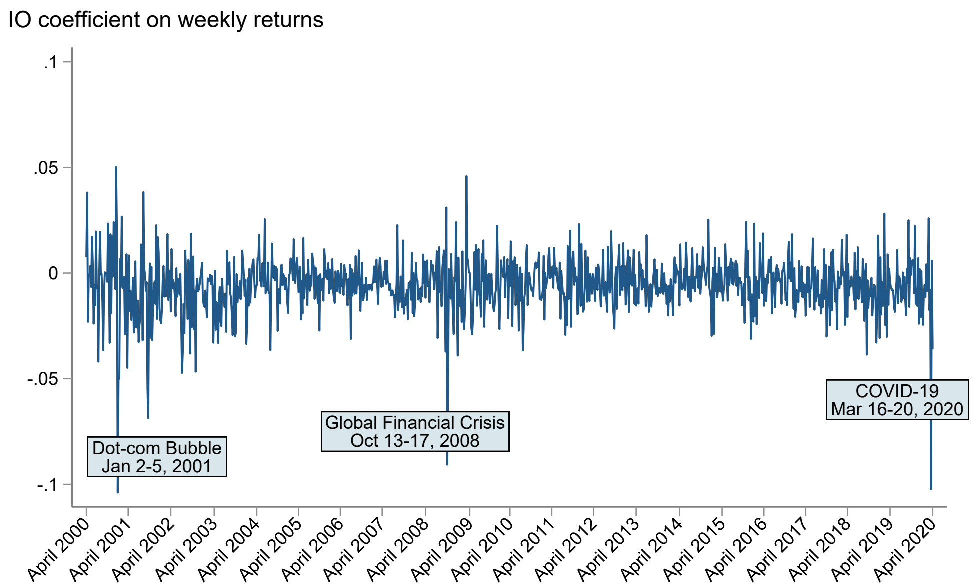


Figure 3: Change in institutional ownership (IO)
Panel A shows the difference in the distribution of Δ*IO Q1-2020*, the stock-level changes in institutional ownership of Russell 3000 non-financial constituents between Q4-2019 and Q1-2020, compared to Δ*IO 2019Q4*, the equivalent changes between 2019-Q3 and Q4-2019. Panel B shows in a binned scatter plot (with 20 bins) the relation between changes in IO during Q1-2020 Δ*IO Q1-2020* and the cumulative retail flows to individual stocks (based on Vanda Research data) over the same period.

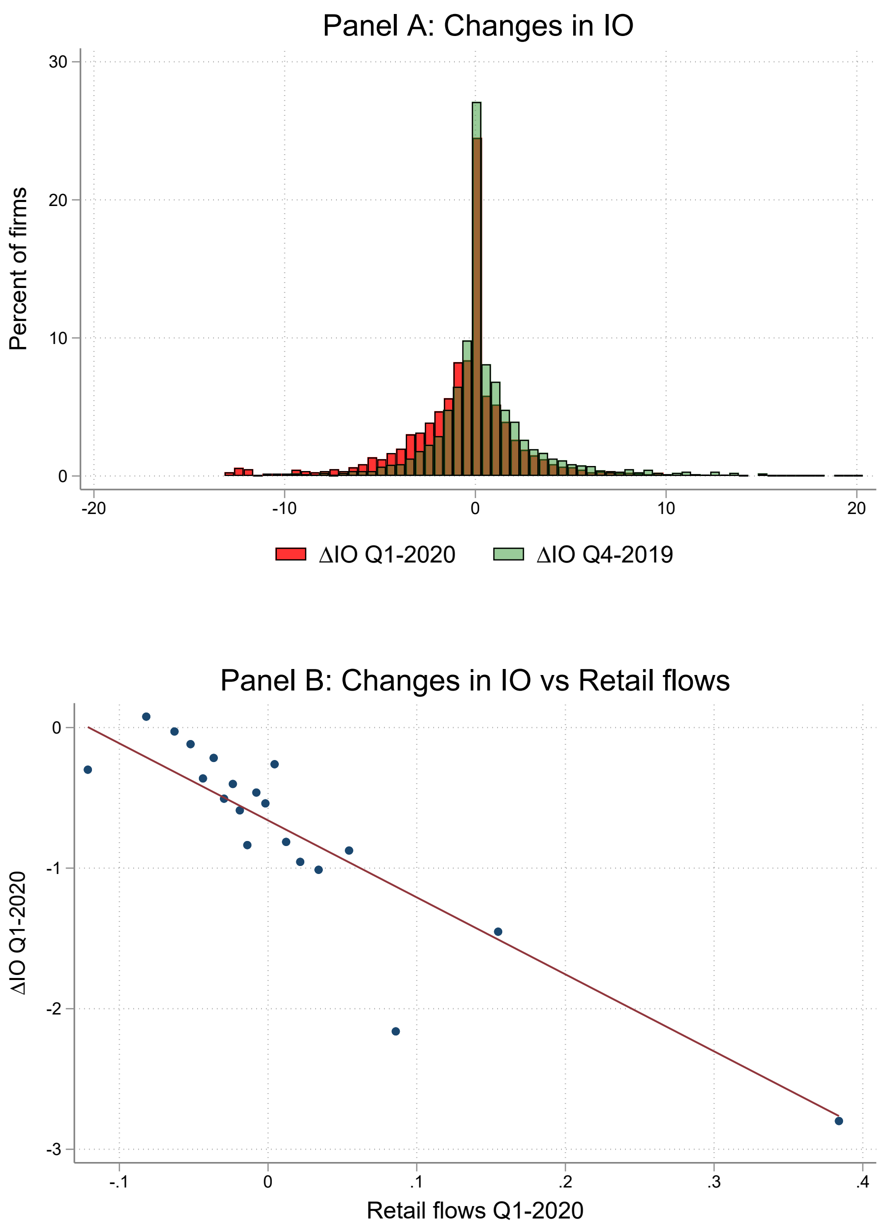


Figure 4: Disentangling downscaling and repositioning changes in institutional ownership (IO)

This graph shows the distributions of stock-level changes during Q1-2020 in the ownership by institutional investors that display a large downscale of their equity portfolios (*Downscaling* ΔIO *Q1-2020*, Panel A) and by institutional investors that do not (*Repositioning* ΔIO *Q1-2020*, Panel B). (Figure A3 in the Appendix further shows the distributions of the two sub-classes of *Downscaling* ΔIO *Q1-2020*, proportional and discretionary.)

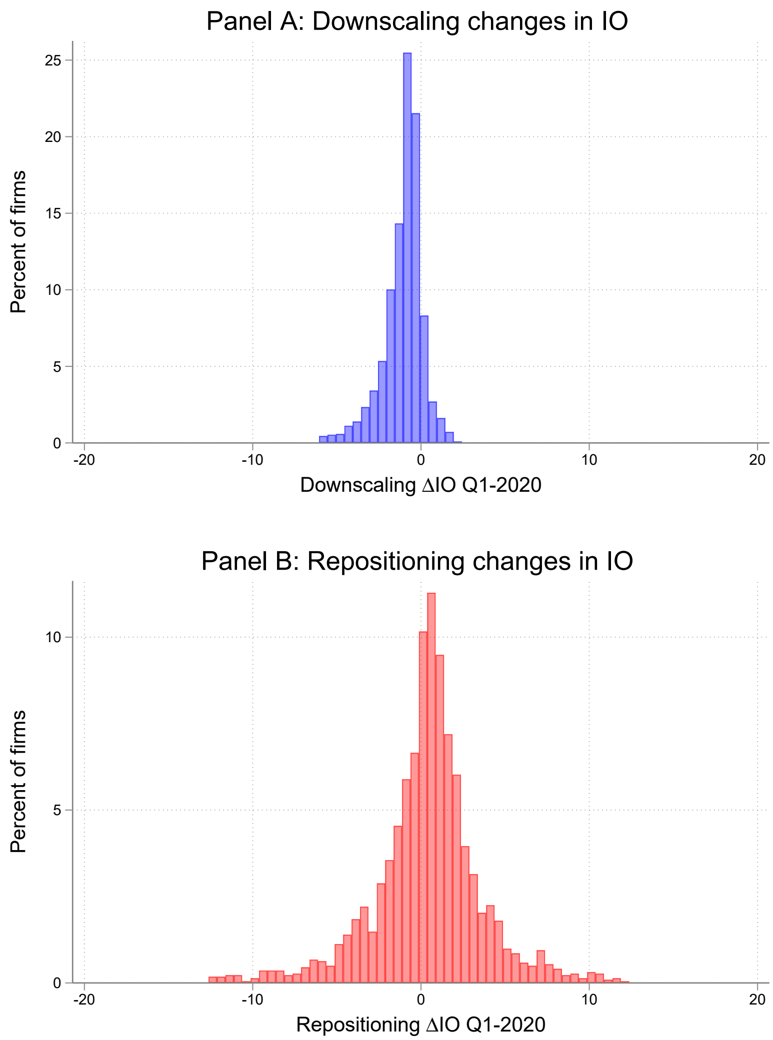


Figure 5: Change in institutional ownership (IO) and firm characteristics
This figure shows binned scatter plots (with 20 bins) of changes in institutional ownership in Q1-2020 on firm leverage and cash holdings. Panel A focuses on changes in ownership by institutional investors that display a large downscale of their equity portfolio in Q1-2020 (*Downscaling* Δ*IO Q1-2020*) while Panel B on changes by institutional investors that do not (*Repositioning* Δ*IO Q1-2020*). The plots control for firm size, profitability, book-to-market, and the level of IO at the end of the previous quarter.

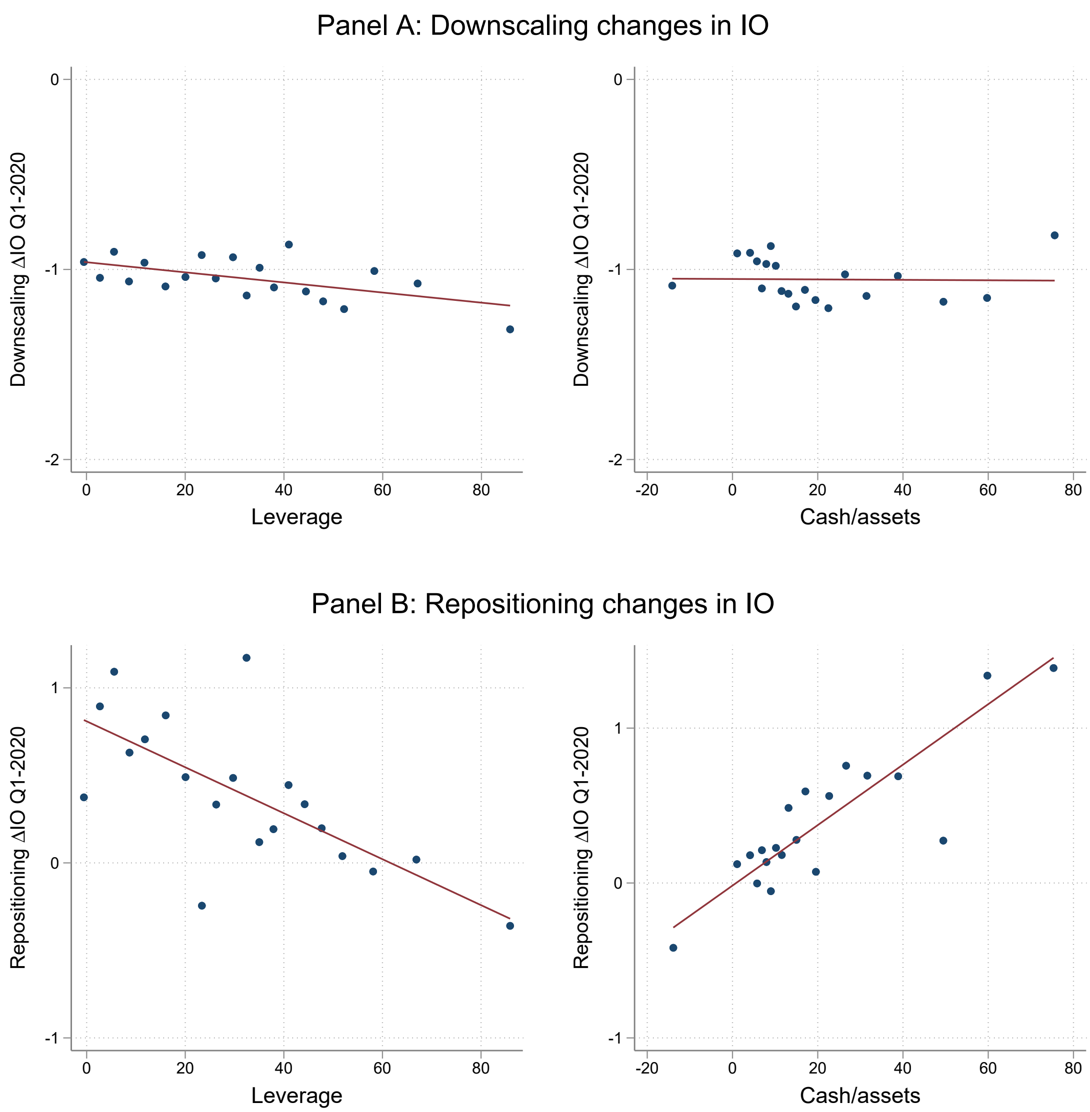
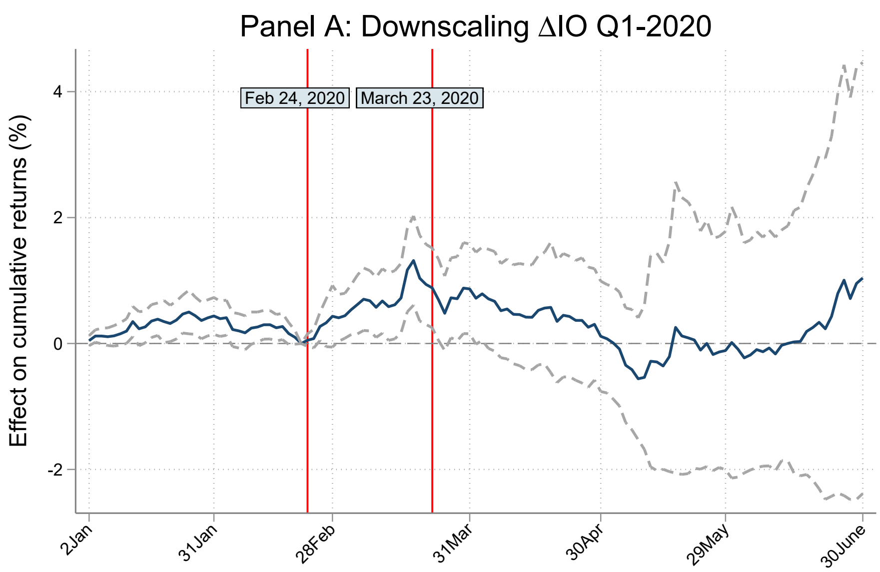
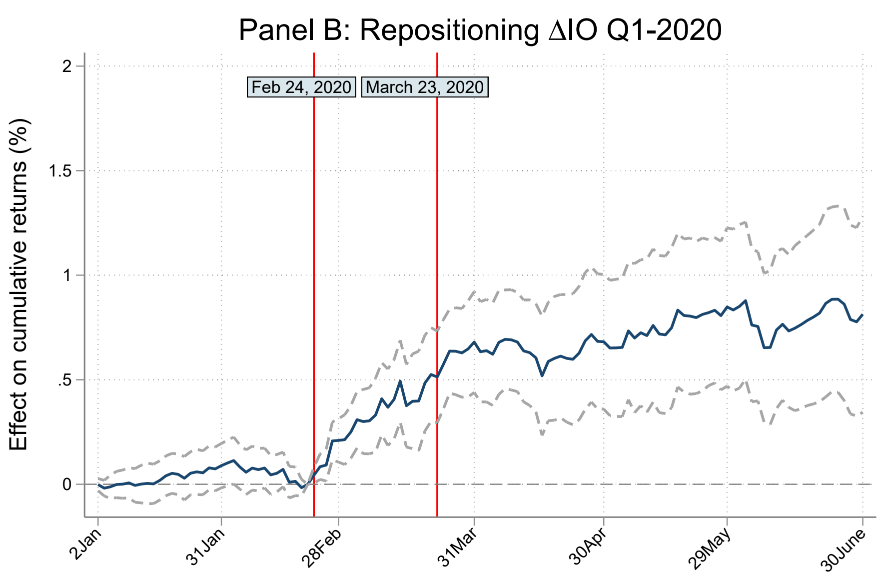


Figure 6: Stock-price effects of downscaling and repositioning changes in IO
This graph shows the evolution of the coefficients on *Downscaling* Δ*IO Q1-2020* (Panel A) and *Repositioning* Δ*IO Q1-2020* (Panel B) in regressions with the cumulative returns of Russell 3000 non-financial stocks from January 2, 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. In addition, the regressions also control for cumulative returns before the Fever period. The red vertical lines mark the beginning and the end of the Fever period (from February 24 through March 20, 2020).





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 Q4-2019	2,271	1.94	71.50	81.04	88.22	98.39	100.00	21.44
Passive Q4-2019	2,271	0.00	9.53	16.34	16.92	23.09	57.58	8.66
Long-term IO Q4-2019	2,271	0.02	23.05	37.29	40.31	51.24	90.28	18.34
Foreign IO Q4-2019	2,271	0.00	2.69	8.86	5.96	10.63	100.00	13.03
ΔIO Q1-2020	2,222	-13.15	-1.84	-0.72	-0.06	0.47	9.70	3.04
Repositioning ΔIO Q1-2020	2,224	-12.63	-1.03	0.38	0.53	1.91	12.01	3.24
Downscaling ΔIO Q1-2020	2,225	-6.06	-1.56	-1.05	-0.83	-0.34	1.96	1.16
Downscaling ΔIO Q1-2020 (prop.)	2,247	-4.92	-1.16	-0.93	-0.73	-0.48	0.62	0.73
Downscaling ΔIO Q1-2020 (disc.)	2,225	-2.96	-0.53	-0.10	-0.16	0.25	3.93	0.92
Repositioning High-leverage IO Q4-2019	2,271	0.03	28.82	44.02	47.89	60.21	95.81	20.54
Repositioning Low-cash IO Q4-2019	2,271	0.00	7.19	17.25	16.13	24.86	87.96	12.56
Retail flows Q1-2020	1,932	-0.17	-0.04	0.01	-0.01	0.03	0.76	0.11
%Δ log(1+RHusers) Q1-2020	2,202	-5.20	1.49	7.30	4.37	9.51	53.39	9.28
Stock returns and firm characteristics data								
Return in Fever (Feb23-Mar20,2020)	2,282	-88.03	-50.25	-38.77	-38.19	-27.53	144.53	19.46
Return in Recovery (Mar23-Dec31,2020)	2,216	-81.37	42.01	113.40	80.74	144.77	1,899.38	128.16
Leverage	2,229	0.00	13.26	32.27	31.81	46.21	100.00	22.74
Cash/assets	2,282	0.00	2.71	20.78	8.78	28.44	99.74	25.94
Market beta	2,273	-3.02	0.81	1.13	1.12	1.46	5.64	0.53
log(Market cap)	2,269	3.41	6.44	7.70	7.59	8.78	13.84	1.71
Profitability	2,282	-30.35	-1.15	-1.10	0.59	1.71	9.33	6.07
Book-to-market	2,269	-6.49	0.16	0.44	0.33	0.59	8.67	0.60
Stock illiquidity	2,257	0.00	0.02	1.11	0.11	0.56	21.62	3.15
ΔEPS_{2020}	1,823	-16.52	-0.48	-0.49	-0.06	0.00	11.46	1.88
ΔEPS_{2021}	1,987	-16.91	-0.42	-0.39	-0.04	0.00	12.11	1.77
ΔEPS_{2022}	1,495	-15.63	-0.49	-0.42	-0.03	0.00	14.58	2.03

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, and other controls (market beta, log(market cap), profitability, book-to-market, and stock illiquidity). Columns 2 to 4 also include measures of institutional ownership by passive, long-term, and foreign institutions. 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)
Dependent variable:	Return in Fever (Feb24-Mar20, 2020)			
IO Q4-2019	-0.081***	-0.119***	-0.156***	-0.092***
	(-3.47)	(-3.76)	(-4.03)	(-3.85)
Passive IO Q4-2019		0.146**		
		(2.00)		
Long-term IO Q4-2019			0.115***	
			(2.80)	
Foreign IO Q4-2019				0.080**
				(2.36)
Leverage	-0.108***	-0.105***	-0.107***	-0.111***
	(-5.14)	(-4.98)	(-5.10)	(-5.25)
Cash/assets	0.082***	0.089***	0.088***	0.083***
	(3.44)	(3.71)	(3.72)	(3.49)
Market beta	-5.480***	-5.513***	-5.610***	-5.434***
	(-5.59)	(-5.63)	(-5.74)	(-5.57)
log(Market cap)	1.394***	1.359***	1.098***	1.254***
	(5.93)	(5.77)	(4.23)	(5.11)
Profitability	0.261**	0.258**	0.263**	0.262**
	(2.39)	(2.37)	(2.42)	(2.41)
Book-to-market	0.793	0.778	0.899	0.775
	(0.96)	(0.95)	(1.10)	(0.94)
Stock illiquidity	0.232	0.268*	0.205	0.224
	(1.53)	(1.78)	(1.34)	(1.49)
Constant	-35.231***	-34.477***	-31.238***	-33.968***
	(-10.75)	(-10.39)	(-8.33)	(-10.10)
Observations	2,196	2,196	2,196	2,196
R-squared	0.260	0.261	0.263	0.262
Industry FE	Yes	Yes	Yes	Yes

Table 3: Institutional ownership changes and firm characteristics
This table shows the results of OLS regressions of Q1-2020 individual-stock changes in ownership by institutional investors that display a significant reduction in their equity portfolio (*Downscaling* ΔIO *Q1-2020*, column 1-3) and by institutional investors that do not (*Repositioning* ΔIO *Q1-2020*, columns 4-6) on firms' leverage, cash holdings, and EPS forecast revision at the 2021 horizon. All models control for the prior level of IO, firm characteristics (cash/assets, leverage, market beta, stock illiquidity, log(Market cap), profitability, and book-to-market), and industry fixed effects. t-statistics based on robust standard errors are presented in parentheses. ***, **, and * indicate that the coefficient estimate is significantly different from zero at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable:		*Downscaling* ΔIO *Q1-2020*			*Repositioning* ΔIO *Q1-2020*	
Leverage	-0.002			-0.009**		
	(-1.53)			(-2.20)		
Cash/assets		-0.001			0.010**	
		(-0.65)			(2.23)	
ΔEPS_{2021}			-0.030*			0.158***
			(-1.85)			(2.74)
IO_{2019Q4}	-0.008***	-0.008***	-0.008***	-0.006*	-0.006*	-0.011***
	(-6.16)	(-6.42)	(-5.84)	(-1.81)	(-1.82)	(-2.64)
log(Market cap)	0.074***	0.072***	0.070***	0.085*	0.096**	0.021
	(5.40)	(5.19)	(4.66)	(1.84)	(2.09)	(0.43)
Profitability	-0.004	-0.005	-0.008	0.036**	0.048***	0.040*
	(-0.88)	(-0.99)	(-1.29)	(2.26)	(2.94)	(1.93)
Book-to-market	-0.050	-0.036	-0.094	-0.354**	-0.264*	-0.255
	(-0.95)	(-0.71)	(-1.55)	(-2.56)	(-1.93)	(-1.59)
Market beta	0.077	0.076	0.122*	-0.238	-0.265	-0.196
	(1.17)	(1.17)	(1.77)	(-1.47)	(-1.64)	(-1.04)
Stock illiquidity	0.042***	0.043***	0.046***	-0.048*	-0.041	-0.078*
	(5.77)	(5.94)	(3.60)	(-1.90)	(-1.60)	(-1.85)
Observations	2,153	2,202	1,936	2,154	2,203	1,935
R-squared	0.063	0.061	0.061	0.067	0.065	0.068
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes

Table 4: Stock-price effects of institutional trades

This table shows OLS regression results of stock-level returns in the Fever period (from February 24 through March 20, 2020, columns 1-3) and in the Recovery period (March 23 through December 31, 2020, columns 4-6) on measures of institutional ownership changes during Q1-2020. All models control for firm characteristics (cash/assets, leverage, market beta, stock illiquidity, log(Market cap), profitability, and book-to-market) and GICS industry group fixed effect indicators. t-statistics based on robust standard errors are presented in parentheses. ***, **, and * indicate that the coefficient estimate is significantly different from zero at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable:		*Return in Fever* (Feb24-Mar20, 2020)			*Return in Recovery* (Mar23-Dec31, 2020)	
ΔIO Q1-2020	0.725***			-1.494		
	(4.62)			(-0.94)		
Downscaling ΔIO Q1-2020		1.202***			-7.280**	
		(3.22)			(-2.37)	
Repositioning ΔIO Q1-2020		0.589***	0.643***		-1.525	-1.385
		(3.88)	(4.09)		(-0.93)	(-0.86)
Downscaling ΔIO Q1-2020 (prop.)			1.982***			-24.949***
			(2.81)			(-4.10)
Downscaling ΔIO Q1-2020 (disc.)			1.025**			0.946
			(1.98)			(0.24)
Leverage	-0.116***	-0.109***	-0.103***	0.716***	0.648***	0.579***
	(-5.60)	(-5.23)	(-4.98)	(3.97)	(3.59)	(3.28)
Cash/assets	0.087***	0.081***	0.093***	0.206	0.258	0.179
	(3.59)	(3.47)	(3.80)	(1.19)	(1.50)	(1.01)
Observations	2,153	2,118	2,105	2,093	2,059	2,050
R-squared	0.271	0.268	0.271	0.147	0.150	0.156
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes

Table 5: Stock-price amplification of institutional portfolio repositioning
This table shows OLS regression results of individual stock returns in the Fever period (from February 24 through March 20, 2020, columns 1-3) and in the rest of 2020 (columns 4-6) on interactions between firms' financial flexibility (leverage and cash holdings) and institutional ownership characteristics. Panel A investigates the role of institutional investors' exposure to high-leverage (*Repositioning High-leverage IO Q4-2019*) and low-cash stock holdings (*Repositioning Low-cash IO Q4-2019*). Panel B investigates the effect of passive ownership (*Passive IO Q4-2019*). All models control for firm characteristics (cash/assets, leverage, market beta, stock illiquidity, log(Market cap), profitability, and book-to-market) and 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: The role of IO exposure to financial fragility

	(1)	(2)	(3)	(4)
Dependent variable:	*Return in Fever* (Feb24-Mar20, 2020)		*Return in Recovery* (Mar23-Dec31, 2020)	
Repositioning High-leverage IO Q4-2019 × Leverage	-0.002***		0.012**	
	(-3.30)		(2.14)	
Repositioning Low-cash IO Q4-2019 × Cash/assets		0.006***		-0.049***
		(2.87)		(-3.17)
Repositioning High-leverage IO Q4-2019	0.017		-0.602**	
	(0.51)		(-2.39)	
Repositioning Low-cash IO Q4-2019		-0.093**		-0.471
		(-2.26)		(-1.53)
Leverage	-0.002	-0.107***	0.213	0.659***
	(-0.05)	(-5.61)	(0.80)	(4.65)
Cash/assets	0.087***	0.044	0.164	0.476**
	(3.71)	(1.62)	(0.94)	(2.31)
Observations	2,196	2,030	2,130	2,022
R-squared	0.261	0.268	0.144	0.148
Industry FE	Yes	Yes	Yes	Yes

Panel B: The role of passive IO

	(1)	(2)	(3)	(4)
Dependent variable:	*Return in Fever* (Feb24-Mar20, 2020)		*Return in Recovery* (Mar23-Dec31, 2020)	
Passive IO Q4-2019 × Leverage	-0.007***		0.030**	
	(-3.86)		(2.16)	
Passive IO Q4-2019 × Cash/assets		0.006***		-0.024
		(3.26)		(-1.64)
Passive IO Q4-2019	0.401***	0.063	-2.725***	-1.368**
	(4.16)	(0.85)	(-3.82)	(-2.45)
Leverage	-0.001	-0.108***	0.222	0.661***
	(-0.04)	(-5.73)	(0.92)	(4.78)
Cash/assets	0.097***	0.016	0.127	0.436*
	(4.15)	(0.50)	(0.73)	(1.79)
Observations	2,196	2,196	2,130	2,130
R-squared	0.266	0.265	0.148	0.147
Controls	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes

Table 6: Changes in institutional ownership through the end of 2020
This table shows OLS regression results of quarterly stock-level changes in institutional ownership from Q2 through Q4-2020 on our measures of stock-level changes in institutional ownership in Q1-2020. Columns 1-3 regress following-quarter changes in ownership by institutional investors that display a large downscaling of their equity portfolios in Q1-2020, while columns 4-6 regress following-quarter changes by institutional investors that do not. All models control for firm characteristics (cash/assets, leverage, market beta, stock illiquidity, log(Market cap), profitability, and book-to-market) and industry fixed effects. t-statistics based on robust standard errors are presented in parentheses. ***, **, and * indicate that the coefficient estimate is significantly different from zero at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable:	*Downscaling* Δ *IO*			*Repositioning* Δ *IO*		
	Q2-2020	*Q3-2020*	*Q4-2020*	*Q2-2020*	*Q3-2020*	*Q4-2020*
Downscaling ΔIO Q1-2020	-0.023	0.029	-0.021	0.007	-0.030	0.035
	(-0.83)	(1.14)	(-0.82)	(0.08)	(-0.41)	(0.49)
Repositioning ΔIO Q1-2020	0.025***	0.015*	-0.006	0.111***	0.032	-0.018
	(2.80)	(1.67)	(-0.63)	(2.72)	(1.14)	(-0.68)
Leverage	-0.001	-0.001	0.000	-0.017***	-0.002	-0.002
	(-0.45)	(-0.96)	(0.24)	(-3.48)	(-0.62)	(-0.47)
Cash/assets	0.001	0.000	0.005***	0.026***	0.014***	0.002
	(0.82)	(0.02)	(3.14)	(4.72)	(2.99)	(0.46)
Observations	2,082	2,070	2,042	2,083	2,066	2,045
R-squared	0.026	0.023	0.030	0.128	0.032	0.016
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes

Table 7: Net retail flows and IO changes
This table shows OLS regression results of stock-level quarterly net investment flows by retail investors over 2020 on measures of stock-level changes in institutional ownership in Q1-2020. All models control for firm characteristics (cash/assets, leverage, market beta, stock illiquidity, log(Market cap), profitability, and book-to-market) and industry fixed effects. 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)
Dependent variable:		*Retail flows*		
	Q1-2020	*Q2-2020*	*Q3-2020*	*Q4-2020*
Downscaling ΔIO Q1-2020	-0.012***	-0.015**	-0.018***	-0.007
	(-3.51)	(-2.17)	(-3.32)	(-1.35)
Repositioning ΔIO Q1-2020	-0.007***	-0.006**	-0.003	-0.002
	(-4.88)	(-2.27)	(-1.43)	(-0.89)
Leverage	0.000**	0.001***	0.001**	0.001*
	(1.97)	(3.44)	(2.51)	(1.95)
Cash/assets	0.000**	0.001**	0.001***	0.000
	(2.30)	(1.99)	(3.52)	(0.95)
Observations	1,818	1,823	1,823	1,824
R-squared	0.090	0.092	0.085	0.042
Controls	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes

Appendix

Table A1: Variable definitions

Institutional and retail investor ownership data
Sources: FactSet, Vanda, and Robinhood

IO Q4-2019	is the percentage of common stocks held by institutional investors as of Q4-2019, truncated at 100.
ΔIO Q1-2020	is the change between Q4-2019 and Q1-2020 in the percentage of common stocks held by institutional investors, trimmed at the 1st and 99th percentiles.
Passive IO Q4-2019	is the percentage of institutional ownership held by large passive institutional investors (BlackRock, Vanguard, and State Street).
Long-term IO Q4-2019	is the percentage of institutional ownership held by institutional investors with a portfolio churn rate (averaged over four quarters) in the bottom tercile as of Q4-2019. We calculate an investor's portfolio churn rate as in Gaspar, Massa, and Matos (2005).
Foreign IO Q4-2019	is the percentage of institutional ownership held by non-domestic institutional investors as of Q4-2019.
Downscaling ΔIO Q1-2020	is the change between Q4-2019 and Q1-2020 in the percentage of common stocks held by institutional investors that experienced flows equal or below the 10th percentile during the first quarter of 2020.
Repositioning ΔIO Q1-2020	is the change between Q4-2019 and Q1-2020 in the percentage of common stocks held by institutional investors that experienced flows above the 10th percentile during the first quarter of 2020, trimmed at the 1st and 99th percentiles.
Downscaling ΔIO Q1-2020 (prop.)	is the assumed change between Q4-2019 and Q1-2020 in the percentage of common stocks that can be attributed to institutional investors that re-scaled their portfolio proportional to their overall reduction in their equity portfolio during the first quarter of 2020. In calculating this variable, we consider only institutional investors with a change in the size of equity portfolios equal to or below the 10th percentile during Q1-2020.
Downscaling ΔIO Q1-2020 (disc.)	is the difference between *ΔIO Q1-2020* and *Downscaling ΔIO Q1-2020 (prop.)*.
Repositioning High-leverage IO Q4-2019	is the percentage of institutional ownership held by institutional investors with above-median value-weighted exposure to *Leverage* as of Q4-2019.
Repositioning Low-cash IO Q4-2019	is the percentage of institutional ownership held by institutional investors with below-median value-weighted exposure to *Cash/assets* as of Q4-2019.
ΔIO Q1-2020 (HF)	is the change between Q4-2019 and Q1-2020 in the percentage of common stocks held by institutional investors classified as hedge funds, trimmed at the 1st and 99th percentiles.
ΔIO Q1-2020 (not HF)	is the change between Q4-2019 and Q1-2020 in the percentage of common stocks held by institutional investors not classified as hedge funds, trimmed at the 1st and 99th percentiles.
Retail flows Q1-2020	is a stock's cumulative daily net retail dollar flows in Q1-2020 divided by its market capitalization at the end of 2019, times 100.
log(1+RHusers) Q4-2019	is the natural logarithm of the Robinhood users (plus one) holding a firm's stock as of December 31, 2019.
%Δ log(1+RHusers) Q1-2020	is the percentage change in log Robinhood users (plus one) between December 31, 2019 and March 31, 2020.

Stock returns and firm characteristics
Sources: Compustat North America, IBES, and Refinitiv

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).
Return in Recovery	is computed by compounding daily returns (adjusted for stock splits and dividends) from March 23 through December 31, 2020 (the Recovery 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 Q4-2019, truncated at 100%.
Cash/assets	is cash and cash equivalents over total assets (che*100/at) as of Q4-2019, 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 Q4-2019.
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.
ES score	is the average of the 2018 environmental and social scores from the Thomson Reuters Refinitiv/ASSET4 database.

Table A2: Robustness: Stock returns and institutional ownership

This table shows OLS regression results of individual stock returns in the Fever period on institutional ownership (IO), using alternative specifications from those reported in Table 2. Column 1 does not control for log(Market cap). Column 2 controls for measures at the 3-digit NAICS level from Dingel and Neiman (2020) (*Teleworkable jobs*) and Koren and Pető (2020) (*Affected share*) of sectoral exposures to the pandemic. Column 3 controls for momentum, defined as the buy-and-hold returns from January 2 through February 21, 2020. Column 4 controls for size and value betas. Column 6 controls for firms' ES scores. Column 7 controls for revisions in analysts' earnings forecasts at different horizons. t-statistics based on robust standard errors are presented in parentheses. ***, **, and * indicate that the coefficient estimate is significantly different from zero at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable:		Return in Fever (Feb24-Mar20, 2020)				
IO_{2019Q4}	-0.067***	-0.108***	-0.081***	-0.081***	-0.076**	-0.089**
	(-2.89)	(-4.35)	(-3.50)	(-3.42)	(-2.48)	(-2.41)
Affected share		-0.047*				
		(-1.66)				
Teleworkable jobs		0.027*				
		(1.73)				
Momentum			-0.064***			
			(-2.70)			
Size beta				-1.430**		
				(-2.43)		
Value beta				-0.582		
				(-0.58)		
ES score (asset4)					0.027	
					(1.21)	
ΔEPS_{2020}						-0.184
						(-0.30)
ΔEPS_{2021}						1.395**
						(2.26)
ΔEPS_{2022}						0.411
						(0.89)
Leverage	-0.109***	-0.144***	-0.107***	-0.106***	-0.115***	-0.078***
	(-5.16)	(-6.41)	(-5.09)	(-4.94)	(-4.47)	(-2.65)
Cash/assets	0.069***	0.149***	0.086***	0.079***	0.148***	0.064*
	(2.89)	(7.05)	(3.60)	(3.14)	(4.81)	(1.92)
Market beta	-5.921***	-6.095***	-5.564***	-4.541***	-8.840***	-4.273***
	(-5.99)	(-6.77)	(-5.69)	(-4.16)	(-6.83)	(-2.99)
log(Market cap)		1.859***	1.440***	1.074***	0.874**	1.421***
		(7.19)	(6.13)	(3.86)	(2.04)	(4.34)
Profitability	0.351***	0.152	0.257**	0.248**	0.327**	0.237
	(3.24)	(1.41)	(2.37)	(2.29)	(2.01)	(1.46)
Book-to-market	-0.183	-0.463	0.442	1.064	1.334	1.403
	(-0.22)	(-0.51)	(0.54)	(1.26)	(1.23)	(0.78)
Stock illiquidity	0.013	0.153	0.240	0.190	0.463	-0.200
	(0.09)	(1.01)	(1.60)	(1.25)	(1.05)	(-0.88)
Observations	2,196	2,082	2,196	2,196	1,506	1,273
R-squared	0.250	0.149	0.263	0.262	0.307	0.250
Industry FE	Yes	No	Yes	Yes	Yes	Yes

Figure A1: Quarterly changes in IO during 2019
These graphs show the distribution of quarter-to-quarter changes in institutional ownership in 2019.

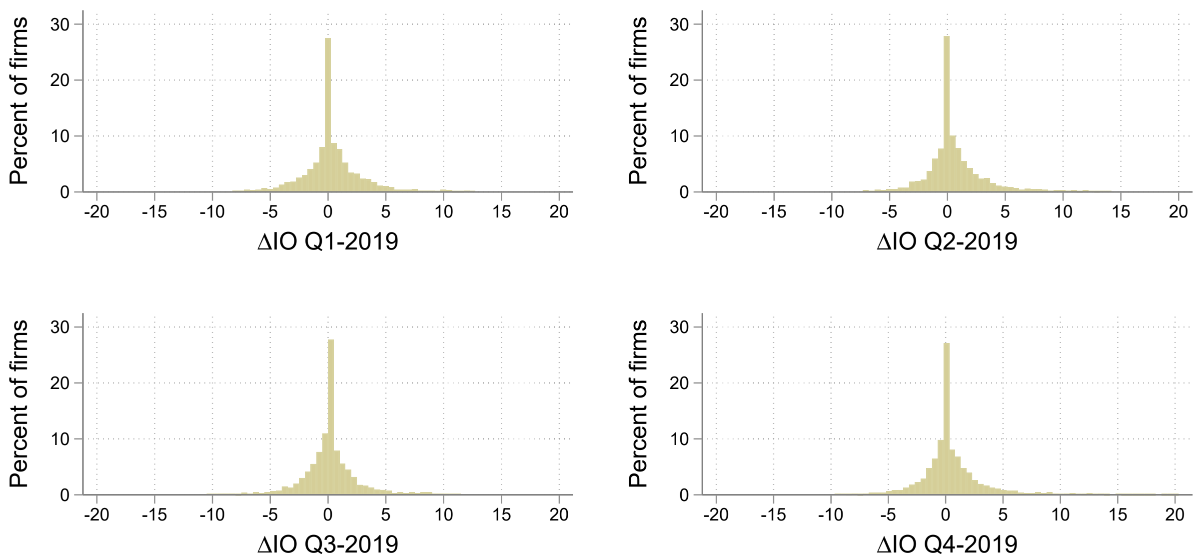


Figure A2: Robustness: Change in institutional ownership (IO) and Robinhood attention

This graph shows in a binned scatter plot (with 20 bins) the relation between the change in institutional ownership between Q4-2019 and Q1-2020 and the percentage change in a stock's popularity with Robinhood investors (the log of Robinhood users holding the stock, *%Δ log(1+RHusers) Q1-2020*) over the same period.

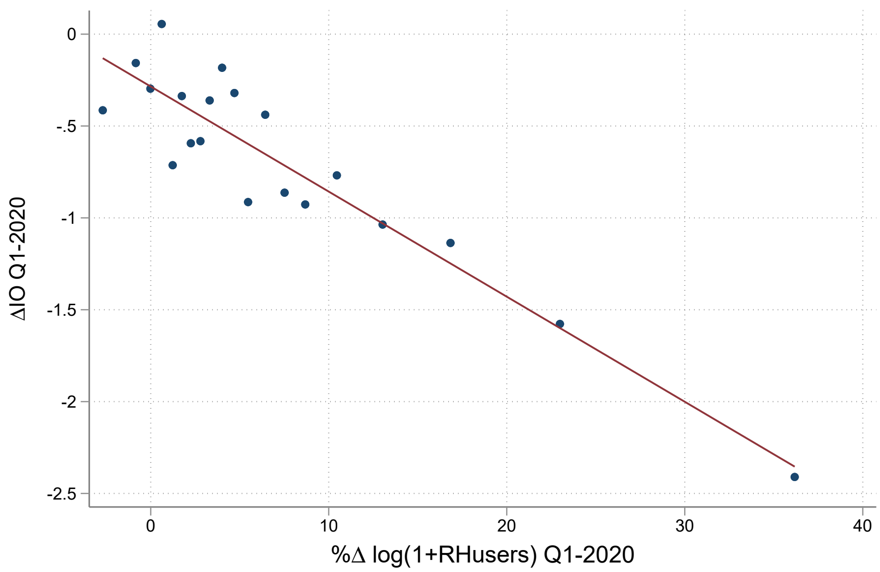
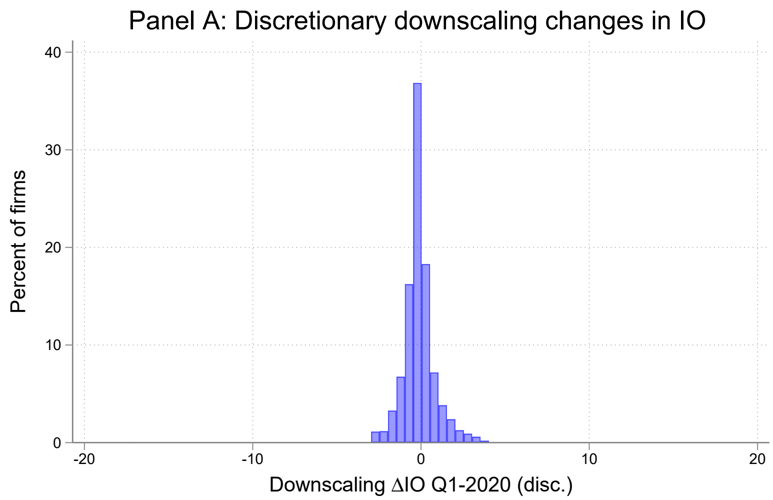


Figure A3: Disentangling proportional and discretionary downscaling changes in institutional ownership (IO)
This graph shows the distributions of the two sub-measures of downscaling changes in IO during Q1-2020, discretionary (*Downscaling* Δ*IO Q1-2020 (disc.)*, Panel A) and proportional (*Downscaling* Δ*IO Q1-2020 (prop.)*, Panel B).



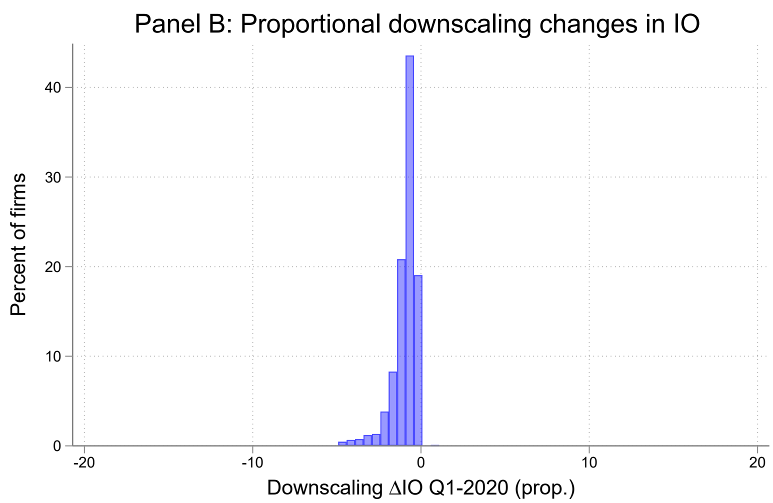


Table A3: Robustness: Determinants of downscaling and repositioning changes in IO -- Alternative measures

This table replicates the analyses in Table 4 employing as dependent variables the alternative measures of institutional ownership changes during Q1-2020: *Downscaling* Δ*IO Q1-2020 (alt)* (columns 1-3) and *Repositioning* Δ*IO Q1-2020 (alt)* (column 4-6). These alternative measures are computed using the ''at least 10% of equity portfolio reduction'' threshold to identify downscaling institutional investors in Q1-2020. All models control for firm characteristics (cash/assets, leverage, market beta, stock illiquidity, log(Market cap), profitability, and book-to-market) and GICS industry group fixed effect indicators. t-statistics based on robust standard errors are presented in parentheses. ***, **, and * indicate that the coefficient estimate is significantly different from zero at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable:		*Downscaling* Δ*IO Q1-2020 (alt)*			*Repositioning* Δ*IO Q1-2020 (alt)*	
Leverage	-0.002			-0.013***		
	(-1.02)			(-3.31)		
Cash/assets		-0.003			0.013***	
		(-1.51)			(2.98)	
ΔEPS_{2021}			-0.034			0.201***
			(-1.45)			(3.72)
IO_{2019Q4}	-0.008***	-0.008***	-0.008***	-0.005	-0.005	-0.009**
	(-5.02)	(-5.29)	(-4.71)	(-1.45)	(-1.43)	(-2.27)
log(Market cap)	0.010	0.005	-0.002	0.143***	0.158***	0.090*
	(0.54)	(0.25)	(-0.11)	(3.10)	(3.43)	(1.79)
Profitability	0.001	-0.001	-0.004	0.046***	0.060***	0.051**
	(0.17)	(-0.19)	(-0.46)	(2.72)	(3.48)	(2.40)
Book-to-market	-0.138*	-0.132*	-0.205***	-0.312**	-0.180	-0.167
	(-1.80)	(-1.74)	(-2.66)	(-2.12)	(-1.28)	(-0.95)
Market beta	0.101	0.101	0.127	-0.291*	-0.345**	-0.223
	(1.27)	(1.27)	(1.50)	(-1.76)	(-2.09)	(-1.14)
Stock illiquidity	0.031***	0.031***	0.027	-0.028	-0.018	-0.043
	(2.87)	(2.87)	(1.56)	(-1.15)	(-0.73)	(-1.04)
Observations	2,152	2,201	1,933	2,154	2,203	1,935
R-squared	0.041	0.041	0.041	0.067	0.064	0.067
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes

Figure A4: Change in institutional ownership (IO) and firm characteristics
This figure shows binned scatter plots (with 20 bins) of changes in institutional ownership in Q1-2020 on measures (at the 3-digit NAICS level) of how much job activities in different sectors are exposed to the pandemic's social distancing measures. *Teleworkable jobs* is obtained from Dingel and Neiman (2020) and represents the share of jobs that can be performed at home. *Affected share* is obtained from Koren and Pető (2020) and reflects the share of occupations affected by social distancing. Panel A focuses on changes in ownership by institutional investors that display a large downscale of their equity portfolio in Q1-2020 (*Downscaling* Δ*IO Q1-2020*), while Panel B on changes by institutional investors that do not (*Repositioning* Δ*IO Q1-2020*). The plots control for firm size, profitability, book-to-market, and the level of IO at the end of the previous quarter.

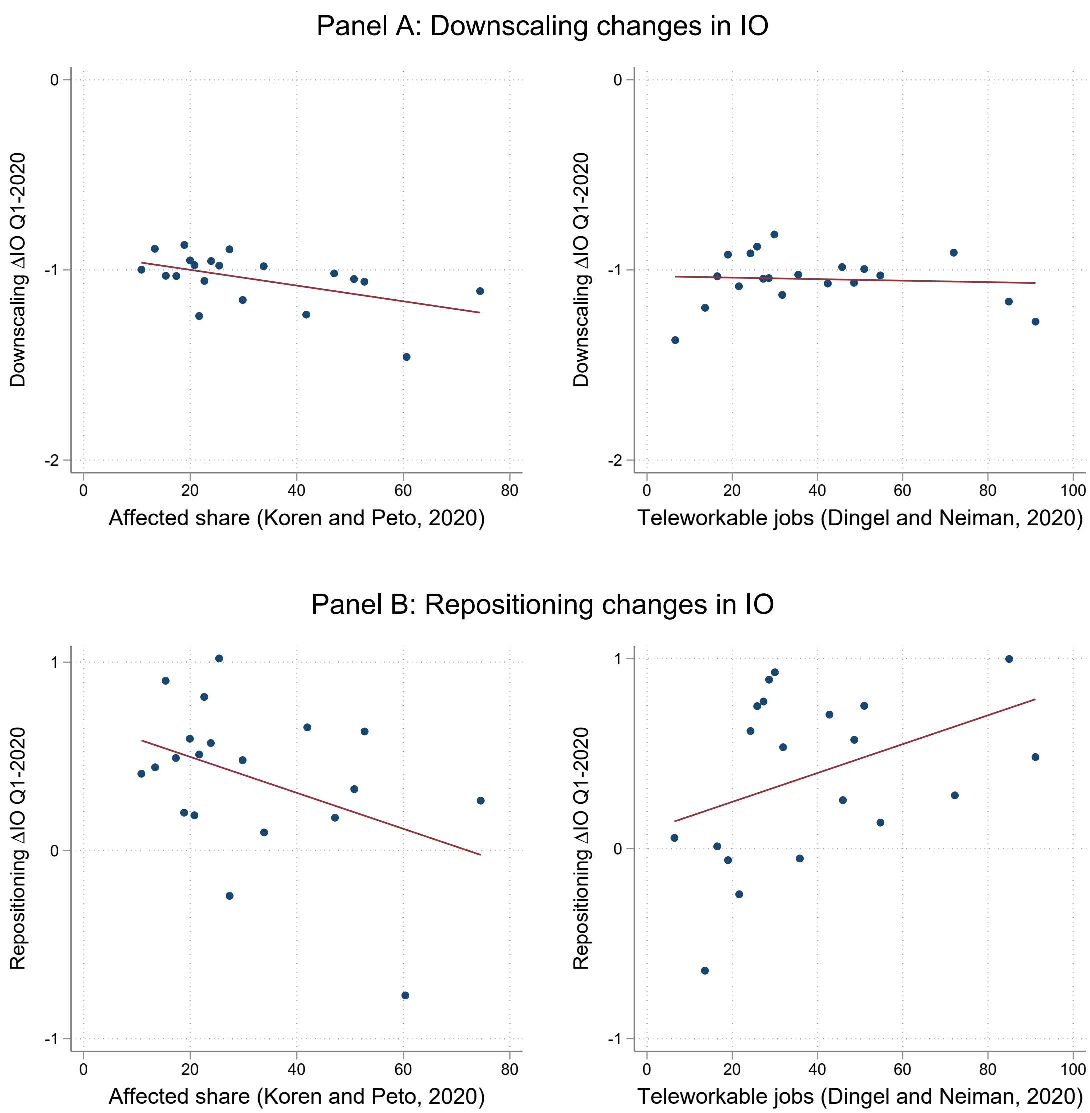


Table A4: Robustness: Stock-price effects of institutional trades, controlling for forecast changes

This table replicates the analyses in Table 4, additionally controlling for revisions during the Fever period in analysts' earnings forecasts at the 2020, 2021, and 2022 horizons. All models also control for firm characteristics (cash/assets, leverage, market beta, stock illiquidity, log(Market cap), profitability, and book-to-market) and GICS industry group fixed effect indicators. t-statistics based on robust standard errors are presented in parentheses. ***, **, and * indicate that the coefficient estimate is significantly different from zero at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable:		*Return in Fever* (Feb24-Mar20, 2020)			*Return in Recovery* (Mar23-Dec31, 2020)	
ΔIO Q1-2020	0.930***			-1.094		
	(5.67)			(-0.92)		
Downscaling ΔIO Q1-2020		1.406***			-5.845*	
		(3.22)			(-1.84)	
Repositioning ΔIO Q1-2020		0.726***	0.786***		-1.322	-0.883
		(4.48)	(4.74)		(-1.13)	(-0.74)
Downscaling ΔIO Q1-2020 (prop.)			1.548**			-19.127***
			(2.13)			(-3.59)
Downscaling ΔIO Q1-2020 (disc.)			1.731***			-2.880
			(3.08)			(-0.70)
Leverage	-0.090***	-0.084***	-0.082***	0.564***	0.504***	0.486***
	(-3.50)	(-3.35)	(-3.17)	(3.06)	(2.81)	(2.66)
Cash/assets	0.069**	0.063**	0.073**	0.058	0.105	0.058
	(2.24)	(2.08)	(2.37)	(0.26)	(0.48)	(0.26)
ΔEPS_{2020}	-0.347	-0.252	-0.266	1.320	1.642	1.463
	(-0.88)	(-0.67)	(-0.70)	(0.47)	(0.62)	(0.54)
ΔEPS_{2021}	1.330***	1.373***	1.350***	1.590	1.907	1.238
	(3.21)	(3.33)	(3.21)	(0.53)	(0.65)	(0.41)
ΔEPS_{2022}	0.367	0.391	0.427	0.870	0.371	0.885
	(1.31)	(1.41)	(1.51)	(0.43)	(0.19)	(0.44)
Observations	1,247	1,227	1,221	1,215	1,197	1,192
R-squared	0.267	0.268	0.268	0.160	0.169	0.172
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes

Table A5: Robustness: Stock-price effects of institutional trades -- Alternative measures

This table replicates the analyses in Table 4 employing as explanatory variables the alternative measures of institutional ownership changes during Q1-2020: *Downscaling ΔIO Q1-2020 (alt)* and *Repositioning ΔIO Q1-2020 (alt)*. These alternative measures are computed using the "at least 10% of equity portfolio reduction" threshold to identify downscaling institutional investors in Q1-2020. All models control for firm characteristics (cash/assets, leverage, market beta, stock illiquidity, log(Market cap), profitability, and book-to-market) and 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)
Dependent variable:	*Return in Fever* (Feb24-Mar20, 2020)		*Return in Recovery* (Mar23-Dec31, 2020)	
ΔIO Q1-2020	0.497***		-1.250*	
	(4.89)		(-1.65)	
Downscaling ΔIO Q1-2020 (alt)		0.920***		-5.918***
		(3.48)		(-2.97)
Repositioning ΔIO Q1-2020 (alt)		0.533***		-0.290
		(4.35)		(-0.32)
Observations	2,193	2,114	2,130	2,060
R-squared	0.263	0.267	0.143	0.150
Industry FE	Yes	Yes	Yes	Yes

Table A6: Stock-price effects of institutional trades, value weighted

This table shows the results of OLS regressions of stock returns in Fever weighted by market capitalization. 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)
Dependent variable:	*Return in Fever* (Feb24-Mar20, 2020)	
Downscaling Δ IO Q1-2020		4.897***
		(4.69)
Repositioning Δ IO Q1-2020		1.773***
		(3.39)
Constant	-30.754***	-27.451***
	(-29.00)	(-18.94)
Observations	2,185	2,185
R-squared	0.000	0.080
Industry FE	Yes	Yes

Table A7: Stock-price effects of hedge funds and other institutions' trades
This table shows OLS regression results of individual stock returns in the Fever period (from February 24 through March 20, 2020, columns 1-3) and in the rest of 2020 (columns 4-6) on measures of institutional ownership changes during Q1-2020 by hedge funds (HF) and other institutional investors (not HF). All models control for firm characteristics (cash/assets, leverage, market beta, stock illiquidity, log(Market cap), profitability, and book-to-market) and 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)
Dependent variable:	*Return in Fever* (Feb24-Mar20, 2020)		*Return in Recovery* (Mar23-Dec31, 2020)	
ΔIO Q1-2020 (not HF)	0.528***		-1.222	
	(3.56)		(-1.02)	
ΔIO Q1-2020 (HF)	0.392**		-1.357	
	(2.02)		(-0.78)	
Downscaling ΔIO Q1-2020 (not HF)		0.610**		-4.829***
		(2.27)		(-3.61)
Repositioning ΔIO Q1-2020 (not HF)		0.603***		-1.919
		(4.02)		(-1.59)
Downscaling ΔIO Q1-2020 (HF)		1.053**		-5.496
		(2.39)		(-1.59)
Repositioning ΔIO Q1-2020 (HF)		-0.113		-0.088
		(-0.58)		(-0.05)
Observations	2,193	2,115	2,130	2,107
R-squared	0.263	0.280	0.143	0.158
Controls	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes

Table A8: Change in Robinhood investor popularity and IO changes

This table shows OLS regression results of the percentage change during Q1 (column 1) and Q2 of 2020 (column 2) in the popularity of a stock with Robinhood investors (%Δ log(1+RHusers)) on measures of stock-level changes in institutional ownership in Q1-2020. Data on the following quarters are not available. All models control for firm characteristics (cash/assets, leverage, market beta, stock illiquidity, log(market cap), profitability, and book-to-market) and industry fixed effects. 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)
Dependent variable:	%Δ log(1+RHusers) Q1-2020	%Δ log(1+RHusers) Q2-2020
Downscaling ΔIO Q1-2020	-1.425	1.990
	(-0.40)	(0.98)
Repositioning ΔIO Q1-2020	-8.179***	-0.494
	(-5.04)	(-0.67)
Leverage	0.506***	0.363***
	(2.89)	(3.16)
Cash/assets	-0.489**	-0.267*
	(-2.36)	(-1.74)
Observations	2,058	2,061
R-squared	0.185	0.081
Controls	Yes	Yes
Industry FE	Yes	Yes

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